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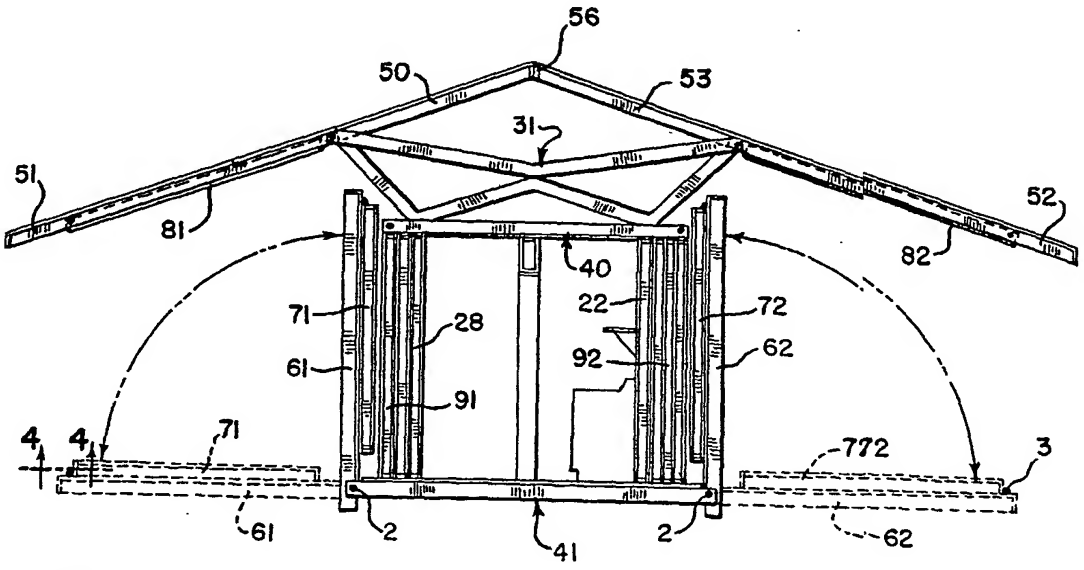

(57) Abstract

A prefabricated structure, illustratively a residential dwelling, having a prefabricated centrtral core (5) and a plurality of prefabricated floors (61, 62), wall (71, 72, 91-99) and roof members (50-53) that pivotally fold ii inwardly about the central core (5) to produce a compact folded structure which is easily transportable, and pivotally fold outwardly about the central core for quick and inexpensive on-site installation. Also methods for erecting sturdy habitable e structures and the sturdy habitable structures themselves.

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PREFABRICATED FOLDING STRUCTURE

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to prefabricated structures, illustratively residential dwellings, which have a prefabricated central core and are comprised of a plurality of prefabricated floor, wall and roof members that fold inwardly about the core to produce a compact partially collapsed folded structure, which is easily transportable, and fold outwardly from the core for quick and inexpensive on-site installation.

Background of the Invention

Over the years, the vast majority of structures, particularly residential houses, were completely constructed on-site. Specifically, once a suitable building lot has been chosen by a prospective home owner or developper, the lot was sufficiently cleared to accommodate a suitable foundation for the home. Shortly thereafter, construction proceeded through a sequence of stages. For each stage to occur, necessary materials and skilled labor were brought to

the site. For example, after the foundation was llaid, the shell of the house was constructed by a team of caarpenters which cut to length and appropriately nailed togetther a requisite number of standard dimension wooden studds, illustratively 8, 10 or 12 foot sections of 2" x 44" or 2" x 6" studs. Thereafter, exterior wall and rooff sheathing, and interior sub-floors were installed using appropriately sized plywood sheets, followed by thhe installation of exterior siding and roof shingles.. Simultaneously therewith, the windows and the heatting, electrical and plumbing systems were installed by carpenters, heating contractors, electricians and plumbers, respectively. Insulation was then added to the sttructure followed by the installation of all the interior wwalls and floors. Thereafter, the necessary appliances weree put in position and connected to the appropriate electriccal and plumbing systems. This, in turn, was illustrativeely followed by all remaining interior work such as paainting, wall-papering, installation of interior trim and tthe like and any external landscaping.

While complete on-site construction, in aa manner typified by that described above, has been the preedominant form of house construction, construction costs, nooteably labor, have substantially increased during the passt two decades to the point where a significant number off buyers can no longer afford the price of a new house.

Consequently, various alternatives have bbeen put forth in the art aimed at providing economically ppriced housing. In general, these alternatives all involve

prefabricating various portions of a house at a ceentral facility or plant by resident teams of skilled labbor, transporting these portions to a building site andd then performing the remaining assembly work on-site. IIt was generally thought that by prefabricating all or a significant portion of a house, sufficient cost savings wwould occur so that the purchase price of the installed prefabbricated house would be advantageously less than that of a similarly sized conventionally constructed house. However, ffor a variety of reasons, the installation cost of each of these prefabricated prior art structures was substantiall and, when added to the cost of manufacture and delivery, cauused the total cost of any of these prefabricated structurees to exceed that of conventional construction.

One such prior art prefabricated structurce is described in U.S. Patent 3,501,875 (issued to J.J.. de Mailly on March 24, 1970). This house is comprised of a number of rooms whose walls have been prefabricated from strcessed concrete. Each room is nested inside another, to form two groups of nested rooms which are then loaded onto a flat-bed truck for the shipment to a building site. During on-site installation, a crane lifts each room from its nessted group and appropriately positions it on a floor which haas been attached to a suitable foundation. The rooms are then attached to each other. Thereafter, a prefabricatted roof is laid in place over all the positioned rooms.

A house of this type carries a significannt installation cost for the following illustrative reasonss. First, since wiring and plumbing cannot be run within conncrete

walls, this necessitates that the rooms be electrically wired and plumbed at the time of on-site installation. In addition, nesting prevents any closets from being installed in any room until after the house has been installed on-site. Furthermore, any foundation used to support this house must be sufficiently strong to support its substantial weight and is thus usually fabricated from reinforced concrete which is quite expensive. Lastly, since a prefabricated house of the type described in the '875 patent is not self-supporting, steel columns or pillars are incorporated into the walls in order to support the weight of the roof. Unfortunately, steel columns are not standard in residential construction and hence, further increase the cost of the house.

Another approach was disclosed in U.S. Patent 3,348,344 (issued to L. Tatevossian on October 24,, 1967). There, the prefabricated house is comprised of a pre-wired and plumbed central core surrounded on each of two sides by a number of folding rooms which share a common end wall that rides along a track. Each room contains two side walls connected at one end to a respective end wall and at the other end to the central core. Each side wall has a full-height hinge which collapses the wall with accordion-like folds. For shipping, the walls and floors are all folded inwardly towards the central core, and the roof sections of the house are folded down around the folded walls.. During installation, the house is first positioned on a suitable foundation. The roof sections are first raised and the floor is then extended. Thereafter, to unfold the house,

each end wall is pulled outwardly on its track frcom the central core and is then secured in place at the eend of its travel.

While the installation cost of this foldiing structure is less than that associated with the sttructure disclosed in the '875 patent, it is still too larcge, for the illustrative reasons indicated below, to make the house described in the '344 patent economically viable cover a similarly sized conventionally constructed house. Specifically, because of the substantial weight supportedd by each end wall and the large amount of friction between each end wall and the track in which it rides --particularlly if dirt enters the track, a substantial amount of effort iis required to fully extend each end wall away from the centraal core. Hence, a bulldozer or other heavy equipment must bbe procured, usually by renting at a fairly significant cost, for use in extending these walls away from the core. Furthermore, the accordion-like folds, in the rooms surrcounding the central core, prevent any closets from being locatted anywhere but in the central core. Consequently, tthis severely limits available closet space, and thus nnecessitates that any additional closets be constructed con-site. In addition, this house is primarily constructed ffrom aluminum, which is a non-standard and expensive buuilding material. While unrelated to cost, this prefabriccated house possesses an additional drawback in that it has a relatively high center of gravity, which disadvantageously maakes the house, when folded, readily susceptible to tippingg over.

A further approach is discussed in Italiaan Patent 574,311 (granted to G. Desegnat et al. on March 155, 1978). This patent generally discloses the idea concept oof longitudinally articulating various floor and walll partitions to form a prefabricated house. The pattent states that the house is entirely shop built such that, aafter the partitions are unfolded the house is connected to utilities, an immediately inhabitable unit is provided. The disclosure of this patent however, does not provide or suggesst any specific details which one skilled in the art coulld use to construct a practical operable unit.

SUMMARY OF THE INVENTION

The invention relates to a prefabricated folding structure comprising at least one pre-erected centtral core comprising at least two oppositely arranged wall mmembers and a floor extending between the at least two wall meembers, at least a first pivoting floor section, first pivotiing means connecting the first pivoting floor section to thee central core floor, the first pivoting means comprising meeans for transferring the load of the first pivoting floor section to the central core floor, at least three pivotable wwall members, first means for pivotally connecting the third of the pivotable wall members to the pivoting floor ssection, the first pivotal connection means comprising an eelongated member foldable along a predetermined crease line and capable of substantially maintaining its configuraation when placed in either a folded or an unfolded conditionn about the crease line by a predetermined force, second meanss for pivotally connecting the remaining pivotal wall meembers to

one of the central core wall members, and a plurallity of beams located above the central core for stabiliziing and strengthening the central core. This prefabricateed folding structure is capable of forming either a compact ffolded structure wherein the at least one pivoting floor section and the at least three pivotable wall members are pivotally positioned inwardly about the central core so as tto rest in close proximity thereto and substantially parallell to the core wall member to which the two pivotal wall memmbers are pivotally connected, or a sturdy habitable structuure wherein the at least one first pivoting floor section and the at least three pivotable wall members are pivotally ppositioned outwardly from the central core so as to define att least one room adjacent to the central core.

The central core may comprises at least ttwo pair of oppositely arranged wall members having a generallly rectangular configuration, with a predetermined nuumber of these wall members utilizable as exterior walls annd the remaining central core wall members being interiopr walls.

The first pivoting means further comprisees means for reducing frictional forces during rotation of the pivoting floor section. The first pivotal connectting means conform to a predetermined position of the third ppivotable wall member relative to the pivoting floor sectionn, which position can vary from a generally parallel initiaal position to a predetermined final position. In a preferredd arrangement, the predetermined final position of tthe pivotable wall member is substantially perpendicullar to the pivoting floor section.

Each of the second pivotal connection meaans is also capable of conforming to a predetermined position of the respective remaining pivotable wall members relatiive to the central core wall member. This position can vary from a generally parallel initial position to a predetermmined final position. Here, a preferred predetermined final pposition of the pivotable wall member is substantially perpenddicular to the central core wall member.

The prefabricated structure according to the invention can include at least one folding interioor wall member for dividing the room, a plurality of ceiliing beams above the room, and means for connecting the pluraality of room ceiling beams to the plurality of central corre ceiling beams for horizontal support. The plurality of rooom ceiling beams are also attached to and at least partially supported by the third pivotable wall member.

In one embodiment, the prefabricated struucture described hereinabove further comprises a flat or conventional roof installed on the structure afterr it is unfolded.

The invention also relates to a prefabriccated folding structure comprising at least one pre-ereccted central core comprising at least two pair of oppositely arranged wall members and a floor extending betweeen the wall members, at least two pivoting floor sections, firrst pivoting means connecting a first pivoting floor ssection to the central core floor and second pivoting means cconnecting a second pivoting floor section to the opposite ennd of the

central core floor, the first and second pivoting means each comprising means for transferring the load of the first and second pivoting floor sections to the central coree floor and means for reducing frictional forces in the first and second pivoting means during rotation of the pivoting flooor sections, at least two sets of three pivotable walll members, first means for pivotally connecting each of the tthird of the pivotable wall members to the first and secondd pivoting floor sections respectively, the first pivotal connnection means comprising an elongated member foldable alonng a predetermined crease line and capable of substantiially maintaining its configuration when placed either iin a folded or an unfolded condition about the crease line by a predetermined forcé, the folded condition correspoonding to a generally parallel initial position of the third ppivotal wall members relative to its respective pivotal flloor section and the unfolded condition corresponding tto a predetermined final position of the third pivotal wall members relative to the respective pivoting floor section, second means for pivotally connecting each of the remaining pivotal wall members of each set to each respectivve side of the oppositely arranged central core wall members,, the second pivotal connection means capable of conformming to a predetermined position of the respective remainingg pivotal wall members relative to the central core wall memmbers, which position can vary from a generally parallel initial condition to predetermined final position, and a pplurality of beams located above the central core for stabillizing and strengthening the central core. This prefabricateed folding structure is also capable of forming either a compact folded structure wherein the at least two pivoting floor sections

and each of the at least three pivotable wall membbers are pivotally positioned inwardly about each respectivve side of the central core so as to rest in close proximity thereto and substantially parallel to each of the at leastt two core wall members, or a sturdy habitable structure wherrein the first and second pivoting floor sections and the ppivotable wall members are pivotally positioned outwardly frrom the central core so as to define at least two rooms addjacent to the central core.

The prefabricated structure according to this embodiment further comprises a plurality of ceilinng beams above the rooms and means for connecting each of tthe plurality of room ceiling beams to each end of thee plurality of central core ceiling beams for partial horizonttal support. Also, the plurality of room ceiling beamms are also attached to and at least partially supported by att least one of the pivotable wall members.

Preferably, one pre-erected central core is used, and it includes comprising two pair of oppositely arranged wall members having a generally rectangular configguration and a floor extending between the wall members wheerein a predetermined number of the central core wall membbers are utilizable as exterior wall members and the remainning central core wall members are interior wall memberrs. In this arrangement, the central core contains all neecessary and desired plumbing and electrical control means,, and preferably includes at least a substantially prefaabricated kitchen and a substantially prefabricated bathroomm.

In an alternate embodiment, the prefabriccated folding structure of the invention can include a pplurality of prefabricated roof support trusses attached to the upper sides of one pair of oppositely arranged central ccore wall members and a plurality of folding roof members piivotally connected to the prefabricated roof support trussees. The plurality of folding roof members are capable of ffolding downwardly onto the roof trusses or folding to a pposition parallel to the core wall members.

In addition, the prefabricated folding sttructure according to the folding roof structure may compriise upper and lower folding roof sections wherein each upperr section is pivotally connected at one of its ends to a corrresponding lower section and to the prefabricated roof supporrt trusses. The lower folding roof sections are at least partiially supported by a pivotable wall member which is attaached to a pivoting floor section.

The prefabricated folding structure of thhe invention can further comprise a plurality of freee standing partitions which in the compact folded structure aare positioned substantially parallel to and alongsidee at least one of the interior the central core walls, or wheen the folding structure has been completely unfolded, arre positioned to further define a predetermined numbeer of rooms and closets arranged adjacent to the central core.. The pivotable wall members and the pivoting floor secttions are configured and dimensioned to provide sufficient ffree space parallel to the central core walls when the structture is folded for holding non-pivotally connected buildinng components until the structure is unfolded.

The non-pivotally connected building mateerials comprise free standing wall partitions and roof brrace supports. Also, the central core and pivotable waall members include all necessary cable and wiring requirementts.

The invention also includes a method for erecting a sturdy habitable dwelling from a prefabricated follding structure which comprises prefabricating a compactt folded structure as described hereinabove, transporting tthe compact folded structure to a construction site, supportinng the compact folded structure on at least two properly positioned central core support means, unfolding the compact folded structure by pivoting the first pivoting floor secction to a horizontal position onto support means, pivoting tthe third pivotable wall member to a vertical position with respect to the first pivoting floor section, pivoting the othher pivotable wall members, and finishing final constrruction details to form the sturdy habitable structure. TThis method further comprises adding a plurality of ceiling beeams above the room and attaching these ceiling beams to the central core ceiling beams.

When the prefabricated folding structure comprises at least two adjacent rooms, the compact folded sttructure is unfolded by pivoting the first pivoting floor secttion to a horizontal position ontosupport means, pivoting thhe second pivoting floor section to a horizontal position onnto support means, pivoting each the third pivotable wall membbers to a final position relative to the first and second piivoting floor sections, and pivoting the remaining pivotabble wall members according to a predetermined sequence to ttheir final

positions. Preferably, the final position of the third pivotable wall members is substantially perpendicular to the pivoting floor sections. The final structural details are then completed.

The predetermined sequence of unfolding the remaining pivotable wall members preferably comprises pivoting the outermost wall member outwardly to its final position, pivoting the next outermost wall member outwardly to its final position, and repeating these pivoting steps until all remaining wall members are pivoted outwardly to their final position. The preferred final position of the remaining pivotable wall members is a substantially perpendicular position relative to the central core wall to which it is pivotably connected. Also, this method also contemplates adding a plurality of ceiling beams above the rooms and attaching these beams to each end of the central core ceiling beams.

In order to form a multi-story structure, the invention contemplates a method which comprises prefabricating a plurality of compact folded structures as described hereinabove, transporting the compact folded structures to a construction site; supporting a first compact folded structure on at least two properly positioned central core support means, unfolding the structure by pivoting each pivoting floor sections to a horizontal position onto a support means; pivoting each third pivotable wall member to a vertical position with respect to each pivoting folded floor section, unfolding the remaining pivotable wall members, positioning a second compact folded

structure above the unfolded first structure; unfolding the second compact folded structure in the same manner as the first, and finishing the final structural details to form a sturdy habitable muti-story structure.

The method further comprises repeating the positioning and unfolding steps as often as necessary to form the desired number of stories then adding a plurality of ceiling beams above the rooms and attaching these beams to the central core ceiling beams. Alternately, a flat or conventional roof can then be installed on these ceiling beams, the uppermost structure can be provided with a plurality of prefabricated support trusses attached to its central core ceiling members and a plurality of folding roof members pivotably connected to the prefabricated roof trusses as described hereinabove.

The invention also relates to the sturdy habitable structures produced according to the above-described methods.

Accordingly, an object of this invention is to provide low-cost prefabricated structures which are not only economical to manufacture but are also easy and inexpensive to install on-site, to thereby provide significant cost savings over a similarly sized conventionally constructed structure.

A particular object is to install all the necessary systems - e.g. wiring, plumbing and heating, and appliances in the structure during prefabrication.

Another particular object is to minimize the need for any heavy machinery during installation of thee structure and to minimize the labor and effort required for installation.

A further particular object is to eliminaate the need for any non-standard building materials, and to minimizé the weight of the structure thereby elimiinating the need for both internal columns and a reinforced fooundation.

Lastly, another object is to incorporate as much stability as possible into the structure in order to minimize the tendency of the structure to tip-overr while it is being transported.

BRIEF DESCRIPTION OF THE DRAWING

The invention may be clearly understood ffrom a consideration of the following detailed descriptioon and accompanying drawings, wherein:

FIG. 1 is a perspective view of the outsiide of applicant's prefabricated folding structure shown in a completely folded shipping configuration;

FIG. 2 is a cross-sectional view of appliicant's prefabricated folding structure shown in FIG. 1;

FIG. 3 is a cross-sectional view of pivobt 2 shown in FIG. 2 and taken through section 3-3 of FIG. 8;;

FIG. 4 is a partial cross-sectional view of one of pivots 3 shown in a folded position and taken throough section 4-4 of FIG. 7;

FIG. 5 is a cross-sectional view of one oof pivots 4 shown with interior wall 103 completely pivoted annd taken through section 5-5 of FIG. 12;

FIG. 6 is a cross-sectional view of appliicant's prefabricated folding structure, depicting the pivvotal movement of upper folding roof sections 50 and 53,, and lower folding roof sections 51 and 52;

FIG. 7 is a cross-sectional view of appliicant's prefabricated folding structure, depicting the pivvotal movement of folding floor members 61 and 62;

FIG. 8 is a cross-sectional view of appliicant's prefabricated folding structure, depicting the pivvotal movement of folding front and rear exterior walls 71 and 72, respectively;

FIG. 9 is a partial cross-sectional view of one of pivots 3, shown in a completely unfolded position and taken through section 9-9 of FIG. 11;

FIG. 10 is a plan elevational view of thee interior of applicant's prefabricated folding structure, deepicting the pivotal movement of folding exterior side wallls 91, 92, 93 and 94;

FIG. 11 is a cross-sectional view of applicant's prefabricated folding structure, depicting the pivotal movement of folding ceiling sections 81 and 82 and ceiling support T-braces 86 and 87;

FIG. 12 is a plan elevational view of the interior of applicant's prefabricated folding structure, depicting the positioning of folding walls 101-104 and 108-111, and free-standing partitions 105, 106, and 107;

FIG. 13 is a cross-sectional view of applicant's prefabricated structure, shown completely unfolded;

FIG. 14 is an exterior perspective view of applicant's prefabricated structure shown completely unfolded and installed on-site;

FIG. 15 is a plan elevational view of the interior of another structure shown in a completely unfolded position which embodies the present invention and illustratess its use in structures of different shapes;

FIG. 16 is a cross-sectional view of an altternate embodiment of a single story prefabricated structuree, shown completely unfolded; and

FIG. 17 is a cross-sectional view of applicant's two story prefabricated house shown completely unfolded.

In all the cross-sectional views indicateed herein, which depict the folding structure in various stagges of being unfolded, each cross-sectional view has beenn taken along a section generally similar to that shown byy lines 2-2 of FIG. 10.

Also, to facilitate easy understanding, iidentical reference numerals are used to denote identical ellements common to the figures.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the description that follows, the termms "beam", "stud", "plate", and "rafter" refer to support memmbers as defined below:

1) "beam" indicates a support member lying in a horizontal plane which has a height that is greater than its width;

2) "stud" refers to a support member iin a vertical position;

3) "plate" refers to a flat support member (i.e. - one having a width tthat is greater than either the height oor thickness); and

4) "rafter" is used to indicate a studd or beam in an angled position (i.e. -· in a position other than horizontal opr vertical).

Although the teachings of the present inuvention are applicable to a wide variety of structures of diffferent weight, size, shape and materials for a variety off diverse uses, for purposes of the following description, tthe present invention will be described in the context of a siingle-story prefabricated residential dwelling (house).

FIG. 1 shows an exterior perspective vieww of a single-story prefabricated folding house constructted in accordance with applicant's invention and folded iinto a shipping configuration. As shown, the house contaains a generally rectangularly shaped prefabricated centrral core 5 -- of which only exterior core wall 21 is shown. Positioned substantially parallel to and alongside this core wall -- and discussed in greater detail in conjunction witth FIG. 2 -- are the pivotable front and rear walls and pivooting floor sections.

On the left side of the core, a pluralityy of studs comprising pivotable exterior side wall 71 are pivvotedly connected at one end of the core wall via pivots 33, to the outer end of pivoting floor section 61 at floor jooist 611. Each of these joists in the pivoting floor sectionns are pivotedly connected at its other end, via pivot 2,, to a respective one of the floor joists, e.g. joist 4111, which joists together comprise the floor of central coree.

The floor of the central core is comprised of a plurality of beams positioned substantially perpendicular to the walls of the central core, at least one beam oriented parallel to the walls of the central core connected to each of the plurality of beams, and acceptable decking material attached to and substantially covering the beams.

Preferably, these beams are made of lumber or steel, and the decking material can be plywood, fiberboard or variations of these. In a particularly advantageous embodiment, the decking comprises a subflooring of plywood or the like, followed by a final floor covering of hardwood planking, carpeting, tile or linoleum, depending upon the use for that particular section of the house.

The beams of the central core floor 41, illustratively, are 2" x 10" wooden joists and those of each pivoting floor section are 2" x 10" wooden joists.. It is also possible to use 2" x 8" joists for the pivoting floor sections, rather than 2" x 10", to save material costs. All the joists comprising these floor members are arranged in an approximate 16" center-to-center spacing and are staggered such that an end of each floor joist in each pivoting floor member lies adjacent to an end of a corresponding floor joist in the central core. During prefabrication,, both subflooring, of illustratively 5/8" thick plywood,, and final floor covering, of illustratively 1/4" hardwood planking, are nailed in place over all the joists comprising each of these floor members with exception of an area existing above pivots 2 between each pivoting floor section and the core

floor. Subflooring and final flooring are installled over this area after the house has been fully unfolded, as discussed hereinbelow.

Affixed atop the central core is a ceilinng member (not shown but see 40 in FIG. 2) upon which is possitioned a plurality of prefabricated roof trusses -- of whicch only truss 31 is shown. When a folding structure is ussed as a single story dwelling or the top floor of a multipple story dwelling, these trusses provide support for the foolding roof which is comprised of lower folding roof sections 51 and 52 and upper folding roof sections 50 and 53. Each llower roof section is pivotedly connected at one of its ends to both an end of a respective upper folding roof section andd to an end of each truss. In the shipping configuration as sshown, the lower folding roof sections are pivotedly orientedd downward to lie alongside the pivoting floor section, and tthe upper folding roof sections are pivotedly oriented downwward to lie against each of the trusses.

These folding roof sections preferably ccomprise a plurality of rafters positioned substantially perppendicular to the walls of the core, at least one rafter posiitioned perpendicular to the plurality of rafters for connnection thereto, a sheathing material connected to and subbstantially covering the rafters and moisture barrier means atttached to the sheathing.

The moisture barrier is preferably builder felt, and a building exterior, such aluminum siding, shinglees, cedar shakes, etc., is placed upon the moisture barrier and sheathing materials.

Since the weight of the folding structuree is primarily supported by the walls comprising the ceentral core, relatively little weight is borne by any of the pivoting wall, floor and ceiling members. Consequuently, these pivoting members can be made fairly light inn weight. Not only does this advantageously eliminate the neeed to use a reinforced foundation, but, in addition, this addvantageously minimizes the effort required to pivotallyy move these members into proper position during installaation of the structure. Thus, once the structure is properrly positioned on its foundation, only a minimum amounnt of labor and no heavy machinery is needed to unfold the strructure and complete the installation. These factors, coupleed with the use of only inexpensive standard building materialls and extensive prefabrication, advantageously permit suubstantial cost savings to be achieved over the cost of both prior art prefabricated structures and conventional construuction.

The use of pivoting floor, wall, ceiling and roof members, which fold and unfold in a manner to be ddiscussed in detail shortly, reduces the height and width off the folded home to specifically 11 feet 4 inches and 113 feet 8 inches, respectively. Advantageously, this greatlly lowers the center of gravity of the folded home. Consequuently, this ensures that the house is not susceptible to being

tipped over during shipment. Hence, the house cann be easily and safely transported on a flatbed truck to a suiitable building site.

Once a suitable site has been appropriateely excavated, a concrete foundation is laid. This fooundation is provided with four points for supporting the foldiing structure. Two supports are located just below annd outside of the core walls, and each of the two other suppoorts is located under one of the pivoting floor sections. Thus, the two supports for the core hold the weight of the sstructure while the pivoting floor supports maintain the flooor in the correct orientation and position i.e., parallel tto and level with the core floor. A well known wood plate (nott shown), which is illustratively comprised of a pair of 2" x 6" studs laid one atop another, is affixed all around the ttop surface of this foundation. These studs and the foundatioon are configured and arranged so as to facilitate the unnfolding of the structure. Thereafter, the folded house shownn in FIG. 1 is positioned on top of the wood plate and unfoldeed in a manner discussed below.

FIG. 2 depicts a cross-sectional detail vview of the prefabricated folding house of FIG. 1 taken througgh a section generally resembling 2-2 of FIG. 10. Viewwed in conjunction with FIG. 1 and the interior plan vieww shown in FIG. 10, FIG. 2 shows that applicant's folding houuse is comprised of a rectangularly shaped central core 55, a plurality of folding exterior wall members - - speecifically folding front wall 71, folding rear wall 72 and foolding side walls 91, 92, 93 and 94; and pivoting floor sectioons 61 and

62; folding roof 9 containing folding upper and loower roof section 50 and 53, and 51 and 52, respectively; annd pivoting ceiling members 81 and 82, and lastly a plurality of prefabricated roof trusses of which only truss 31 is shown.

Specifically, central core 5 is comprisedd of interior core walls 22, 23, 24, 26, 27 and 28, andd exterior core walls 21 and 25 all secured, illustratively, by nails to both core floor 41 and ceiling member 40. The central core is completely prefabricated and contains all piping, plumbing, and electrical control means (i.e. - circcuit breaker box, etc.) for connection to external sourrces of supply (i.e. water, gas, electricity, etc.). Alsoo, all necessary systems for the entire structure, e.g. hheating, plumbing and electrical, and all the required applliances and plumbing fixtures are installed in the central corre during prefabrication. Furthermore, any outlets that aree to be located in any of the pivoting members, particularrly the walls, are installed while the structure is being prefabricated.

As shown in FIG. 10, this core contains tthe kitchen including all its appliances; the bathroom -- incluuding the necessary plumbing fixtures, noteably a bathroom ssink, tub/shower and toilet; and a closet with folding ddoors containing the hot water heater, washer and dryer..

Preferably, the core walls each comprise a plurality of studs and at least two plate members connected respectively to the top and bottom of the pluralitty of studs. Since these core walls are located within the foldded

structure, they are provided with gypsum board aftter the necessary piping, plumbing, and electrical componeents have been installed. An advantageous stud is a wooden 2" x 4", although steel, aluminum, or other materials couldd be used, if desired.

Each pivoting exterior wall (front wall 771, rear wall 72 and side walls 91, 92, 93 and 94) is compllletely assembled during pre-fabrication. These walls wouuld be constructed in the same manner as the core walls. One difference, however, is that these walls would eacch have one side facing the exterior of the building. These ffaces would then be covered with a sheathing, moisture barrierr, and finally, the desired exterior facade.

Each wall is specifically fabricated fromm illustratively 2" x 4" x 8 foot wooden studs which aree approximately spaced 16" apart on a center-to-center basiis. During prefabrication, windows are installed at predetermmined locations into these walls, and the exterior surfaace of each folding wall, i.e., that surface which faces the ooutside environment, is covered with standard 1/2" plywoodd sheathing material over which a moisture barrier along with the desired siding material, e.g. aluminum siding, asbbestos shingle or other siding material, is applied. In addition, electrical outlet boxes are affixed to various stuuds in these walls and wired at the factory. To conform with standard building codes, all electrical wiring is placed inside each wall. Thereafter, thermal insulation iis installed within each wall and illustratively 1/2"" gypsum board, (also known as "dry wall" or "sheet rock") is then

installed over the interior surface of each folding exterior wall, with an appropriately located prewired electrrical outlet.

As previously discussed, means for supportting the roof and ceiling of the structure are provided aboove the central core. These means are located on and are supported by the common walls of the core, and preferably coomprise a plurality of prefabricated truss assemblies. Each of the prefabricated trusses provide the necessary structtural support for the upper and lower folding roof sectiions whenever they are pivoted into an open, i.e. unfolided, position. While only one truss 31 is shown in thee cross-sectional view of FIG. 2, the house is illustrativvely comprised of a number of separate trusses, each preferably fabricated from 2" x 4" rafters and mounted on a 224" center to center spacing. Any number of trusses can be uused, with the particular number being predicated upon the deesired spacing between trusses and the size of the structture. The spacing for the trusses (and also for the floor jooists, wall studs and ceiling rafters) is often specified by llocal building codes and/or practice and can thus vary ffrom that specified hereinbelow. Each truss is pivotedly atttached to upper roof sections 50 and 53, and lower roof secttions 51 and 52 of roof 9.

As shown in FIGS. 2 and 10, a number of sstructural members, including pivoting exterior side and fronnt (and rear) walls and a pivoting floor member, are posittioned during prefabrication substantially parallel to annd alongside the interior core walls. Specifically, thesee struc-

tural members are arranged in two groups of similaar members, group 7 being adjacent to interior wall 28 and thee other, group 8, being adjacent to interior wall 22. In tthe shipping configuration shown in FIG. 2, the structtural members comprising each group are positioned alonggside each other and are all substantially parallel to the addjacent interior core wall 22 or 28. Group 7 is comprisedd of free-standing partition 105, folding exterior side walll 91, folding exterior front wall 71 and pivoting floor section 61, and also -- as is apparent from FIG. 10 -- follding interior walls 101-104 and folding exterior side wwall 94. Group 8 is comprised of similar structural memberss and free-standing partitions, specifically: folding eexterior side walls 92 and 93, folding exterior rear wall 772, pivoting floor section 62, folding interior walls 108-112 and free standing partitions 106 and 107. It shouuld be noted that interior walls 101 and 102 are joined ttogether, but are provided with an open area in between for access (i.e., a doorway). The same applies to wall 103 aand 104; 108 and 110; and 109 and 111.

In accordance with this feature of the innvention, substantial closet space is incorporated into the folding structure through the use of the folding interior walls and free-standing partitions. When the structure is ffully folded, these interior walls and partitions are innitially positioned to lie alongside various interior side walls comprising the central core. Once the walls and ffloor members are pivoted into their properly installed positions, an enclosed area is defined around the core. Eachh pivoting interior wall and each free-standing partition aree then

pivoted or moved to a pre-determined position withhin this area in order to define all the rooms arranged aboout the core and all the closets existing therein.

Folding the Structure

The shipping configuration, shown in FIG.. 2, is achieved during prefabrication by first appropriattely pivoting the folding interior walls and positioninng the free-standing partitions against the core walls annd second folding i.e., pivotedly positioning, various strucctural members inwardly about the central core in the mannner described below. Since the structural members commprising group 8 both pivotedly interconnect and fold in a nearly identical manner to those comprising group 7, the following sequence will be described, for the sake of brevitty, with respect to only those members in group 7.

First, free-standing partition 105 is possitioned, as shown in FIG. 12, alongside interior side core wall 28. This partition is preferably oriented such that itts vertical edges are parallel to those of the interior core wwall. In a similar fashion, folding interior walls 101-104 arre pivoted and positioned, as shown in Figs. 10 and 12, such that each lie alongside interior side core walls 26 and 27.

Thereafter, folding ceiling members 81 annd 82 are each pivotedly positioned upwardly, as shown in FIIG. 11, such that each folding ceiling member, e.g. ceilinng member 81, lies partially within and parallel to a corresponding lower folding roof member, e.g. folding roof membeer 51. The

rafters in each folding ceiling member are staggereed with respect to those in each corresponding lower foldinng roof member such that when those ceiling members are folded their joints partially interleave with those in each corrresponding lower roof folding section.

Next, as shown in FIG. 10, folding exterioor side walls 91 and 94 are pivotedly positioned inwardly, about pivots 4, such that these walls lie alongside free--standing partitions 105 and pivoting wall 101, respectively.. Then, as is evident from FIG. 8, folding exterior front wwall 71, which pivots, via one of the pivots 3 about an end of pivoting floor section 61, is pivotedly positioned downward, such that it lies alongside pivoting floor section 61.

Thereafter, as shown in FIG. 7, pivoting floor section 61 is pivoted upward about pivot 2 located in the left end of core floor 41, such that folding exterior front wall 71, particularly its exterior surface, lies allongside folding exterior side wall 91 (and 94 not shown).

Now, with all the exterior folding walls folded inwardly about the core, upper folding roof sectioon 50 and 53 are folded, as shown in FIG. 6, by being pivoteedly positioned downward until each abuts against all the trusses, e.g. truss 31. Lower folding roof sectioons 51 and 52 are then folded by being pivotedly positioned ddownward and inwardly such that each lies vertically alongsside folded floor members 61 and 62, respectively.

Pivots between Folding Structural Members

Pivot 2 exists between folding floor members 61 and 62 and core floor 41. This pivot is comprised of a plurality of identical pivoting assemblies, each connecting a floor joist in the central core to a corresponding floor joist in either of the folding floor members. For purposes of illustration, one such pivoting assembly, i.e. that each such existing between floor joist 611 of pivoting floor section 61 and floor joist 411 of central core floor member 41, is shown in FIG. 3.

This pivot 2 comprises pivoting means for rotation of the pivoting floor section with respect to the central core floor, means for transferring the load from the pivoting floor section to the central core floor. This pivot also includes the means for reducing frictional forces during rotation of the pivoting floor section.

The load transferring means preferably is a metal saddle strap, while the friction reducing means is a metal washer. Also, the saddle strap functions to partially reduce friction between the two support members. The pivoting means is preferably bolting means or the like.

Specifically, this pivoting assembly is comprised of bolt 11 (illustratively a 1/2" ASTM A307 bolt) secured by washers 12 and nut 13. Separate saddle straps 100 and 18, each preferably fabricated from galvanized metal 12 gauge or thicker, are each nailed to a floor joists 411 and 611 respectively, in the vicinity of the pivot. These straps

provide a sliding interface against which each jjoist can rotate without causing any abrasion of either joiist. After floor section 611 has been appropriately pivoted into its unfolded position, nut 13 is completely tightenedd to secure pivoting floor section 61 in position.

Pivot 3 exists between pivoting floor seection 61 and folding exterior front wall 71 and between foolding floor member 62 and folding exterior rear wall 72. Thiis pivot is comprised of a plurality of identical pivoting asssemblies, each connected between every joist in a pivoting floor section and every wall stud in a pivoting exterioor front or rear wall. A partial cross-sectional view of onee of these pivoting assemblies, i.e. that existing between ffloor joist 611 of folding floor member 61 and wall stud 711 of pivoting exterior front wall 71 is shown in FIG. 4.

This pivot 3 includes pivotal means connnected to the pivoting floor and pivotable wall members. The ppivoting means comprises an elongated member which is folddable along a predetermined crease line. This member has sufficient strength to hold its shape and requires a predeteermined force to be moved or bent. This elongated member facillitates changing the position of the wall members relativve to the floor from a generally parallel initial positiion to a predetermined final or unfolded position. Prefeerably, this final position has the wall members substantiallyy perpendicular to the floor.

Also, after the wall members are rotateed to the desired angle, the pivoting means is capable of rretaining the wall in relative position with respect to the fldoor. Although the pivoting means are capable of confoorming to any angle between 0 and 180 degrees, in the most advvantageous

embodiment, the wall is rotated 90° and the pivot maintains the wall in this position without the use of other restraining forces.

Specifically, the pivoting assembly is comprised of a metal plate 721, which is nailed to both floor joist 611 and wall stud 711 by illustratively four nails 7223, sized 10 penny (10 d) common or larger. Two of these nails are driven through the plate and subfloor 612 into floor joist 611, and the remaining two are driven through the plate and gypsum board 713 into wall stud 711. Whenever exterior front wall 71 is fully pivoted upward into position, as discussed later in conjunction with FIG. 9, exterior front wall 71 is oriented perpendicular to pivoting floor section 61 and, as a result, metal plate 721 is bent by the pivoting movement of the folding wall with respect to the folding floor into an "L" shape. This plate is advantageously fabricated from galvanized steel or other material that is sufficiently thick, preferably 16 gauge or wider, such that all the plates alone can hold the wall in an upright perpendicular position and also undergo many bending and unbending operations without showing any signs of stress or fracture.

Pivot 4 includes pivotal means attached to the wall member, the core ceiling and the core floor. The pivotal means comprises means to rotate the wall member to a predetermined angle around the axis of the pivotal means. Also, the pivotal means are positioned and oriented so as to facilitate rotation of the wall member while minimizing the space between the wall member and core wall when the wall member is in an unfolded or open position.

Preferably, the pivotal means comprisess two nails; one between the ceiling and wall, and the other between the floor and wall. These nails are placed slightlyy off center to facilitate rotation of the wall while minimizzing the space between the core wall and rotated wall member.

FIG. 5 illustrates pivot 4. Interior wwall 103 is pivotedly attached, as shown, to core floor 41 aand ceiling member 40 by two nails 49. Each of these nails is sized preferably 16 penny (16d) common or larger. Onee nail is driven through cat block 401 in its upper wall mmember 1033 and the other is driven through cat block 412 innto lower wall member 1035. Cat block 401 is secured by nnails (not shown) to two adjacent ceiling joists -- of whicch only joist 402 is shown. Cat block 412 is secured by nailss (not shown) to adjacent floor joists 411 and 412. Consequenntly, interior wall 103 rotatably pivots about nails 449.

FIG. 5 also shows interior wall 103 in aa completely folded configuration (as shown in phantom in FIGG 12). Pivoting interior wall 103 is comprised of a seqquence of illustratively standard dimension 2" x 4" x 8' wwooden studs -- of which only stud 1034 is shown -- arranged with approximately 16" center to center spacing and nnailed to both upper wall member 1033 and lower wall membeer 1035. A layer of gypsum board 1031 is affixed to each exxterior side of this folding wall 1033.

Core floor 41, as shown and as previoussly discussed, is comprised of illustratively 2" x 10" wooden floor joists -- of which only floor joists 411 and 4133 are shown -- all arranged with an approximate 16" center-tto-center spacing. Subfloor 414 -- illustratively 5/8" pllywood sheet -- is nailed to the core floor joists. Ceiling mmember 40 is

constructed in a similar manner as is core floor 41, with the exception that gypsum board, specifically sheet 403, instead of 5/8" plywood as used in the subfloor,, is nailed to the under surface of the 2" x 4" ceiling beam -- of which only beam 402 is shown.

When fully unfolded, interior wall 103 lies substantially perpendicular to interior core wall 27. This core wall is comprised of a sequence of 2" x 4" x 8' studs -- of which only stud 273 is shown -- arranged on an approximate 16" center to center spacing and nailed to both top wall members 271 and 272 and lower wall member 274, all of which are also illustratively 2" x 4" x 8' woooden studs. Gypsum board 276 is affixed to both sides of interior core wall 27.

Pivots 4 exist between core ceiling 40 and folding exterior side walls 91, 92, 93 and 94, and betweeen core floor 41 and folding exterior side walls 91, 92,, 93, and 94. All pivots connecting each folding exterior side wall to the core ceiling and core floor are identical, and would be similar to the pivot 4 illustrated in FIGS. 5. For the exterior side walls, however, the central core side walls 21, 25 are extended as shown in FIG. 10 provide enough space for the non-pivoting members, such as partition 105, "T-braces" 86, etc..

Unfolding the Structure

Having summarily described the sequence in which the pivoting walls, floor and roof members fold inwardly about the central core to form the folded structure shown in FIGS. 1 and 2, a more detailed explanation will now be given as to the manner in which all the structural members are

sequentially unfolded to transform the house from iits shipping, i.e., folded, configuration into a fully habitable residential dwelling. This sequence is depicted inn FIGS. 6 through 8, and 10 through 12.

The first structural members to be unfoldeed are the roof sections. As shown in Fig. 6, upper folding rroof sections 50 and 53 are pivotedly positioned upward and outward. Ridge beam 56 is preferably a 2" x 6" woooden beam which runs the entire length of upper folding roof section 53 and abuts against the top edge of folding roof ssection 50 when both these roof sections are completely unfoldded. The rafters that comprise each of these upper roof secttions are 2" x 4" wooden beams located on a 24" center-to-cennter spacing, and all the rafters comprising either of tthe upper roof sections are staggered with respect to those cof the other. Once these upper roof sections are completeely unfolded into position as shown in FIG. 6, a pair cof suitably sized nails (not shown), preferably 16 pennny (16d) common or larger, are driven through the ridge beanm and into each rafter comprising upper folding roof section 550 in order to fully secure both upper roof sections in pposition. It should be noted that all upper roof sections hauve been fully sheathed and shingled during prefabrication.

Next, as shown in FIG. 6, lower roof sectiions 51 and 52, each comprised of illustratively 2" x 4" rrafters are pivoted upward and outward into position. These rrafters are connected by pivotal means comprising bolting meanns. Each pivot connecting both the upper and lower roof secttions to the trusses, is comprised of a series of 1/2" boltss (not shown), each of which runs through a rafter in a ldower roof section, an adjacent truss and an adjacent rafter iin upper roof section. A temporary support (not shown) is then

positioned under the lower end of each of these lowwer folding roof sections and is adjusted to an appropriiate height to temporarily keep each lower roof section iin its completely unfolded position. To secure the roof ssections in a final position, a properly sized nut which has been threaded onto the end of each bolt is fully tightenaed. In addition, at least three nails, preferably 16 penny (16d) common or larger, are then driven through each raftcer in the lower roof section and into its adjacent roof trusss, and likewise, three more of these nails are driven throough each rafter in the upper roof section and into its adjaccent roof truss. Again all lower roof sections have been fullly sheathed and shingled during prefabrication.

Once the roof is completely unfolded, thenn as shown in FIG. 7, folding floor member 61 and 62 are pivotted into position. Specifically, both folding floor memberss are pivoted downward and away from the central core, thhereby forming the entire floor for the dwelling.

Thereafter, as shown in FIG. 8, folding exxterior front and rear walls 71 and 72 are unfolded into poosition. Specifically, each wall is pivoted upward and outwaard about pivots 3 until the upper ends of exterior front walll 71 and exterior rear wall 72 abut against all the rafters comprising lower folding roof sections 51 and 52, resppectively.

As can be seen in FIG. 9 and as previouslyy noted in conjunction with FIG. 4, the upward movement of folding exterior front wall 71 away from pivoting floor secction 61 causes metal plate 721 to become "L-shaped". Wheneever folding exterior front wall 71 is fully unfolded, hhorizontal stud 725, which exists at the bottom of this wall, lies on top of subfloor 612 of pivoting folding section memmber 61.

In this position, exterior sheathing 714, which is illustratively 1/2" plywood sheet and which has beeen attached to this wall during pre-fabrication, overhhangs subfloor 611 and end piece 616. This endpiece is nailed to each of the floor joists, by at least 3 nails, preferably 10 penny common or larger, which are all nailed throughh the sheathing and into the endpiece in the vicinity of each floor joist.

With these folding exterior front and reaar walls, secured in place, folding exterior side walls 91, 92, 93, and 94, as shown in the plan view of FIG. 10, are then unfolded into position and secured in place. Specifically, each exterior wall is pivoted outwardly about pivots 4 -- as previously discussed and shown in FIG. 5 -- such that each end wall lies substantially perpendicular to the previously unfolded exterior front or rear walls. Once each folding exterior side wall is pivoted into its properly unfolded position, screw nails (not shown but well known) aare driven through appropriately positioned cat blocks existing between respective adjacent ceiling rafters and floor joissts into the header and lower cross-piece of each of these walls.

At the end walls of the house, the ceilinng and lower roof section are pivotally joined. The pivotal meeans utilized for this connection comprises means for rrotation of the ceiling member with respect to the roof memberr, and means for attaching the ceiling and roof member to the oouter wall member.

At this juncture, folding ceiling memberss 81 and 82, as shown in FIG. 11, are unfolded into positioon. To accomplish this, folding ceiling members are pivotted downward such that unfolded ceiling member 81 liess on top of

unfolded exterior front wall 71 and side walls 91 aand 94; and unfolded ceiling member 82 lies on top of exterrior front wall 72 and side walls 92 and 93, respectively.

Next, unfolded exterior front wall 71 is ssecured to unfolded ceiling member 81 and to lower folding rooof section 51. A plurality of "L-shaped" double nailing platees (not shown but well-known) having a saddle shaped lower extension are positioned such that the saddle of each nailingg plate straddles the header of folded exterior front wall 71. Each nailing plate has an upward vertically oriented secction emanating from one end of the saddle, and is positiioned along the header such that its vertical section abuuts against one of the rafters in the lower roof sectioon. There are as many nailing plates positioned along the heaader as there are rafters in this roof section. Once a plaate is appropriately positioned, it is nailed to both the header -- using preferably at least 6 nails sized 10 penny (110d) common or larger, with two nails driven through thee saddle of the plate into each side of the header and the rremaining two nails driven through the vertically oriented seection in the lower roof rafter. To further secure the unfolded exterior front wall to the lower roof section, a boolt and not assembly (not shown) preferably 1/2" diameter, which has been inserted through a pre-drilled hole existing iin the vertical section in each nailing plate and into a corresponding hole in the adjacent lower roof rafteer during prefabrication, is tightened. Appropriate size wasshers may be used with each bolt. Unfolded exterior rear wahll 72 is secured to lower folding roof section 52 in a substtantially identical fashion.

Since adequate support for the lower roof members is now provided by all the unfolded exterior walls, the jacks that are supporting these lower roof sections are now removed.

Additional support for folding ceiling members 81 and 82 is provided by the installation of a number of "T-braces" as shown in FIG. 11. In the illustrative embodiment shown and described herein, one T-brace, is mounted to a respective upper end of each truss and supports each ceiling member. The number of "T-braces" depends ultimately upon the number of trusses used. Each T-brace extends downward from a side of a upper end of a roof truss and lies in line with a corresponding rafter in a folding ceiling member, and provides a surface upon which the desired ceiling materials can be installed.

Since all the T-braces are approximately the same, for purposes of illustration, only T-braces 86 and 87 which run between truss 31 and folding ceiling members 831 and 82, respectively, are shown, and only T-brace 86 is discussed. T-brace 86 is comprised of an appropriate length of 2" x 4" stud, e.g. stud 861, which extends downward from an appropriate truss to a ceiling rafter, and a relatively short length of 2" x 4" stud, e.g. stud 862, which is positioned perpendicularly to stud 861.

A nailing plate (not shown but well known), fabricated from galvanized 16 gauge or larger metal sheet and having a saddle at one end and a flat nailing surface at the other, can be used to secure the T-brace to the header in ceiling member 81. This plate is positioned too straddle the header such that its flat nailing surface abutts against a side surface near one end (the left end) of studd 862. The

plate is then nailed to both the header and T-brace 86 using preferably 6-10 penny (10d) common or larger sized nnails; four of these nails secure the nailing plate to the header and the other two secure the nailing plate to the bbrace. In a similar fashion, an identical nailing plate can bee used to secure the other end of this "T-brace" to a wooden ccross-piece existing at the right end of core ceiling 40.

Preferably the "T-brace" can be fabricated by two 2" x 4" studs oriented perpendicular to each other aand merely nailed together. This method enable scrap wood to bbe used and is more cost effective than using nailing platess.

These "T-braces" are used to carry the ceilling loads. They are nailed to the core wall and ceilingg members. Then, the weight of the roof is transferred through the "T-brace" to the other members.

Once each "T-brace" is appropriately positioned, it is then secured in position by nails, preferably 16 penny common or larger, driven through its upper end and into the adjacent truss. After all the "T-braces" have been secured, a rectangular sheet of gypsum board, e.g. sheet 863, is nailed to the lower surface of the wooden nailing plates. Each sheet is appropriately sized to both lie flush against the gypsum board previously affixed to the ceiling members during prefabrication and to completely fill in the rectangular opening occurring between the gypsum boards on the underside of each folding ceiling member and the underside of the central core ceiling. All these "T-braces" are completely fabricated during prefabrication of the house and are temporarily stored on the central core floor during shipment of the folded house to the building site.

Onc the folding ceiling members have beenn fully unfolded and secured in position, an enclosed area is defined about this central core. Then, as shown inn the plan view of FIG. 12, folding interior walls 101-104 andd 108-112, and free-standing partitions 105, 106, and 107, aree pivoted or moved into respective positions in this area to define both the rooms arranged about the central core and all the closets contained therein. Specifically, folding iinterior walls 103 and 112 pivot in the same manner as does exterior side wall 92 shown in FIG. 5 and discussed hereinahbove. Once the folding interior walls are pivoted into poosition, then each free-standing partition is appropriately positioned in place. The folding interior walls annd partitions are completely framed and covered with ggypsum board during prefabrication. Once in position, eaach of these interior walls and partitions are secured by screw nails to the floor joists in pivoting floor sectionns 61 or 62, and to the rafters in ceiling members 81 and 822. Specifically. these nails are driven through appropppriately positioned cat blocks, existing between certain adjjacent rafters in the ceiling (and between certain selectted joists in the folding floor members), and into the top (aand bottom) horizontal studs comprising each of these interior folding walls and partitions. Advantageously, the use of free-standing partitions, which are positioned during oon-site installation, to define room sizes and closets, reeadily permits changing the dimensions of these rooms andi closets at any time up to installation without incurring mmuch, if any, expense. While the doors to each of the clossets formed by the free-standing partitions, as well as a numbber of interior room doors, have all been omitted for thee sake of clarity from the plan views shown in the drawing, these doors are attached, i.e. pre-hung, to correspondinng pivotal

walls or free-standing partitions and interior cores walls during prefabrication. Advantageously, this furtheer reduces on-site installation time and expense.

As should be readily apparent, applicant'ss folding prefabricated house is now completely unfolded. A cross-sectional view of it is shown in FIG. 13.

At this stage of installation, the only poortion of the dwelling that remains to be enclosed is the atttic. To accomplish this, a prefabricated gable end is naileed to the outermost roof rafters and ceiling beams existing aat each side of the dwelling. Specifically, each of the twwo gable ends, of which only gable end 97 is shown in FIG. 114, is triangularly shaped and is comprised of a series off 2" x 4" studs (not shown) of appropriate length and mountedd apart from each other on an approximate 16" center to cennter spacing. A layer of sheathing (not shown), preferaably 1/2" plywood, is installed over these studs during prefaabrication at the factory. After the gable ends are installedd on-site, appropriate siding material, e.g. aluminum or shinggle, is applied to the entire side of the house including tthe gable ends. Applying this type of siding in the field addvantag-eously minimizes the likelihood that any mis-alignmment between the siding on the gable ends and that on thhe rest of the exterior side walls will be visible. If, howevver, cedar shingles are used for siding, then any minor mis-allignment between the siding attached to the gable ends and tthat attached to the rest of the exterior side walls is generally not visible. Consequently, this siding material cann be applied during prefabrication to both the gable enads and to all the folding exterior side walls in order to furrther reduce on-site installation time and cost. The prefabri-cated gable ends, like the prefabricated "T-braces", are

temporarily stored in the central core (more speciffically by being placed on the floor of the core) while the foolded house is being shipped to the building site.

The last remaining stage of installation, namely interior finishing, can now proceed. Specifically,, the edges of any interior surfaces of abutting structurral members are appropriately taped, spackled and sandeed, in preparation for applying final wall covering, e. g.. paint, or wallpaper. Thereafter, subflooring and final haardwood planking or other final flooring materials are insttalled in the previously unfloored areas of the house, i.e. aabove pivots 4. Alternatively,the entire sub-floors andd final floor covering can be installed on-site. While thiis latter approach slightly increases installation cost, it mmay be necessary, depending upon the final floor covering chosen by the owner, in order to eliminate any visible gaps cor joint lines from appearing in the floor. Thereafter, mobilding and any remaining interior trim is now installed. At tthis point, the dwelling has been completely constructeed and only requires connection to the local utilities -- e.g. electricity and sewerage -- for it to be completelyy habitable.

An exterior perspective view of the dwelliing as it stands completely installed and ready for occupancyy is shown in FIG. 14.

In the illustrative embodiment described herein, heat is provided through electric baseboard. Whilee electric heat is usually relatively expensive to operate, itt is the least expensive to install. Consequently, separatee electric baseboard units are installed along the interior boottom edge

of various interior core walls and various folding walls. However, to minimize heating costs, a separate therrmostat is installed in each room during prefabrication.

Other types of heating, ventilating, and aair conditioning systems, where desired, can be substittuted for electric baseboard or added in addition thereto. AAny desired system can be substantially shop installed during prefabrication. In addition, the necessary cable oor wiring requirements (i.e., electrical, telephone, televisiion, etc.) can be shop installed during prefabrication.

Since the weight of a residential dwellingg constructed in accordance with the teachings of the prresent invention is primarily supported by the walls comprrising the central core, this advantageously permits all the ppivoting structural members to be made relatively light. Consequently, this permits each member to be pivoteed into position by a few workers without using any heavy mmachinery. Furthermore, the minimal weight inherent in the strructure eliminates the need to incorporate any columns intco the structure or to to construct the foundation from reeinforced concrete. Consequently, these factors advantageoussly reduce installation cost.

A floor plan of one of many alternate emboodiments of a folding residential dwelling embodying the prrinciples of the present invention is depicted in FIG. 15. As is readily apparent from this figure, the exterior pivotable front walls are not limited to being co-planar wheen fully unfolded. As shown, the two walls making up the exterior front wall can be staggered to create a relatively large living room, for example, and also lend a pleasingg appearance to the front of the dwelling. In a similar ffashion,

any of the other folding walls and/or core walls arre also not constrained to entirely lie in a single plane bbut can instead by comprised of a number of staggered or otherwise non-co-planar sections. Moreover, the pivoting flooor and/or ceiling member can also take on many varied non-co--planar geometries to create many diverse and architecturallly pleasing layouts. Consequently, a variety of diffeerently shaped structures, including but by no means limitted to a simple rectangular layout, can be easily fabricatedd using the principles of the invention.

FIG. 16 illustrates a single story structuure which can be provided with a flat roof or used as the firrst or lower floors of a multi-story structure. The singlle story structure or the lower floors of the multi-story sttructure are not provided with folding roofs or roof trussess, but instead have ceiling members 40a only in the area cof the central core. Then, when such structure is to be uused as a single story house, ceiling members 81a, 82a for thhe rooms adjacent to the central core are installed.

These members 81a, 82a shown in phantom in FIG. 16 may be pivotally connected to ceiling members 40a in the same manner as the pivoting floor sections are connecteed to the core floor. Alternately, these ceiling members 81da, 82a may be field installed. In either embodiment, these ceeiling members are partially supported at their opposite end by a pivotable wall member.

Then, a flat or conventional roof can be consttructed upon these ceiling members 40a, 81a, 82a to complette the single story structure. For multi-story construction, the

lower structures are not provided with such ceiling members 81a, 82a, since the floors of the adjacent upper structure 61, 62 become the ceiling members for the lower structure.

For multi-story fabrication, it is advantageous to use 2" x 10" wooden beams 40a positioned upon the central core and to stagger the position of these beams with respect to the position of the floor joists 40 of the upper structure. Also, these beams extend slightly beyond the width of the central core 5 so as to provide enough area to pivotally connect the folding side and internal wall members. In this construction, the floor joists 40 of the upper structure will be positioned between the wooden beams 40a of the lower structure. Also, the core walls, 22, 28 are sufficiently sized to support the weight of the upper structure. Then, as mentioned above, the floor members 61, 62 of the upper structure become the ceiling members of the lower structure.

Specifically, to construct a two-story residential dwelling as shown in FIG. 17, two folding structuures -- an upper and a lower of the type described previously -- are stacked on top of each other. The main differencce between these structures is that the lower structure doess not contain a roof and appears substantially as shownn in FIG. 16. At the time of on-site installation, thhe lower structure is first appropriately positioned on thhe foundation supports and wood plates which forms ppart of the foundation, and is then completely unfolded. All the folding structural members of the lower stucture are thenn secured in position. As shown in FIG. 16, the lower foldingg structure is provided with 2" x 10" ceiling beams 40a straddling the central core. As mentioned above these 2" x 10" beams are positioned in a staggered configuration such thatt they would

not be directly und r the floor joists of the upperr structure. Then, the upper structure, in a completely ffolded position, is placed above the lower structure and tthe floor joists of the upper structure are supported by the walls of central core of the lower structure. In this arranngement, the floor joists of the upper structure 61, 62 beccome the ceiling rafters of the lower structure. All the ceeiling beams 40a of the lower structure thus abut against and are attached to the central core floor joists using appropriately sized nailing plates and nails. The remaining folding structural members of the upper structure aare unfolded into position and secured as described herreinabove.

Appropriate openings are provided both in the ceiling of the central core of the lower structure and in the core floor member of the upper structure duringg their prefabrication in order to accommodate a stair casse, which can be installed in the lower structure during its prefabrication. Any necessary banisters and the liike are installed during the final (interior finishing) staage of on-site installation. Unless the two-story dwellinqg is to be a two family-house, there is little if any need to include any appliances (and/or a hot water heater) in the upper structure. Thus, the area reserved for the kitchenn and closet in the central core can be converted into obther usable space, e.g. a den or study.

As can be readily appreciated by those skiilled in the art, multi-story structures in excess of two sstories can be easily constructed in a similar manner to that described above. The number of separate folding structures that can be stacked to form the multi-story structure is esssentially determined by the weight of each folding structure, and the

amount of weight that can be supported by both the foundation and the walls in each folding structure -- paarticularly the lowest in the stack.

While the pivoting structural members (wallls, floors, ceiling and roof members) comprising the foolding residential dwelling have been described above as ffolding and unfolding in a particular sequence it is readilly apparent to those skilled in the art that any or alll of these structural members can be readily folded and unfolded in a variety of different sequences. The particulaar sequence is determined by the desired volume of thee folded structure and the particular materials used for thee folding members and manner in which these members are consttructed.

Although particular embodiments have been shown and described herein, a substantial variety of differennt embodiments of varying sizes and shapes and all inccorporating teachings of the present invention may be devvised by those skilled in the art without departing from thee spirit and scope of the invention.

THE CLAIMS

I CLAIM:

1. A prefabricated folding structure comprisiing:

(a) at least one pre-erected central core comprising at least two oppositely arranged wall meembers and a floor extending between said at least two wall meembers;

(b) at least a first pivoting floor sectioon;

(c) first pivoting means connecting said ffirst pivoting floor section to said central core floor, said first pivoting means comprising means for transferrring the load of said first pivoting floor section to said ccentral core floor;

(d) at least three pivotable wall members;;

(e) first means for pivotally connecting ssaid third of said pivotable wall members to said pivoting flooor section, said first pivotal connection means compriising an elongated member foldable along a predetermined creease line and capable of substantially maintaining its configguration when placed in either a folded or an unfolded condiition about said crease line by a predetermined force;

(f) second means for pivotally connecting the remaining pivotal wall members to one of said centrral core wall members; and

(g) a plurality of beams located above saiid central core for stabilizing and strengthening said centrall core; the prefabricated folding structure capable of forming either

i) a compact folded structure wherrein said at least one pivoting floor section and said at leaast three pivotable wall members are pivotally positioned inwwardly about said central core so as to rest in close proxximity

thereto and substantially parallel to said core wwall member to which said two pivotal wall members are pivotallly connected, or

ii) a sturdy habitable structure wherein said at least one first pivoting floor section and saidd at least three pivotable wall members are pivotally positidoned outwardly from said central core so as to define at least one room adjacent to said central core.

2. The prefabricated folding structure acccording to claim 1 wherein said central core comprises at leeast two pair of oppositely arranged wall members having a geneerally rectangular configuration.

3. The prefabricated folding structure accoording to claim 2 wherein a predetermined number of said at least two pair of oppositely arranged central core wall memmbers are utilizable as exterior walls with the remaining ceentral core wall members being interior walls.

4. The prefabricated folding structure accorrding to claim 1 wherein said first pivoting means further comprises means for reducing frictional forces during rotatiion of said pivoting floor section.

5. The prefabricated folding structure accorrding to claim 1 wherein said first pivotal connecting meanns conform to a predetermined position of said third pivotablle wall member relative to said pivoting floor section, whhich position varies from a generally parallel initial position to a predetermined final position.

6. Th prefabricated folding structure accoprding to claim 5 wherein said predetermined final position of said pivotable wall member is substantially perpendicular to said pivoting floor section.

7. The prefabricated folding structure accoprding to claim 1 wherein each of said second pivotal connection means conforms to a predetermined position of said respective remaining pivotable wall members relative to said central core wall member, which position varies from a gennerally parallel initial position to a predetermined final position.

8. The prefabricated folding structure accoprding to claim 7 wherein said predetermined final position of said pivotable wall member is substantially perpendicular to said central core wall member.

9. The prefabricated folding structure accoprding to claim 1 further comprising at least one folding interior wall member for dividing said at least one room.

10. The prefabricated folding structure acccording to claim 1 further comprising a plurality of ceiling beams above said at least one room and means for connecting said plurality of room ceiling beams to said plurality of central core ceiling beams for horizontal support.

11. The prefabricated folding structure acccording to claim 8 wherein said plurality of room ceiling beeams are also attached to and at least partially supported by said third pivotable wall member.

12. The prefabricated folding structure acccording to claim 1 further comprising a flat or conventionall roof which is installed on said sturdy habitable structure.

13. A prefabricated folding structure comprrising

a) at least one pre-erected central corre comprising at least two pair of oppositely arranged wall memmbers and a floor extending between said wall members;

b) at least two pivoting floor sections;;

c) first pivoting means connecting a firrst pivoting floor section to said central core floor and secoond pivoting means connecting a second pivoting floor section to the opposite end of said central core floor, said firrst and second pivoting means each comprising means for ttransferring the load of said first and second pivoting floor sections to said central core floor and means for reducing frictional forces in said first and second pivoting means duuring rotation of the pivoting floor sections;

d) at least two sets of three pivotable wall members;

e) first means for pivotally connecting each of said third of said pivotable wall members to said firsst and second pivoting floor sections respectively, said first pivotal connection means comprising an elongated member ffoldable along a predetermined crease line and capable of substantially maintaining its configuration when placed either in a folded or an unfolded condition aboutt said crease line by a predetermined force, said folded conditttion corresponding to a generally parallel initial possition of said third pivotal wall members relative to its rrespective pivotal floor section and said unfolded conditionn corresponding to a predetermined final position odf said third pivotal wall members relative to said respective pivoting floor section;

f) second means for pivotally connectingg each of the remaining pivotal wall members of each set to eacch respective side of said oppositely arranged central core walll members, said second pivotal connection means capable of cconforming to a predetermined position of said respective remaiining pivotal wall members relative to said central core wall mmembers, which position varies from a generally parallel iinitial condition to predetermined final position; and

g) a plurality of beams located above saaid central core for stabilizing and strengthening said centrral core, the prefabricated folding structure capable of forminng either

i) a compact folded structure wherrein said at least two pivoting floor sections and each of saidd at least three pivotable wall members are pivotally positiioned inwardly about each respective side of said centrral core so as to rest in close proximity thereto and substanntially parallel to each of said at least two core wall mmembers, or

ii) a sturdy habitable structure wwherein said first and second pivoting floor sections and saidd pivotable wall members are pivotally positioned outwardly ffrom said central core so as to define at least two rooms aadjacent to said central core.

14. The prefabricated folding structure acccording to claim 13 wherein a predetermined number of said aat least two pair of oppositely arranged central core wall meembers have a generally rectangular configuration and are utiliizable as exterior walls and the remaining central core walll members are interior walls.

15. The prefabricated folding structure acccording to claim 13 further comprising a plurality of ceilinng beams above said at least two rooms and means for conneecting each

of said plurality of room ceiling beams to each end of said plurality of central core ceiling beams for partial horizontal support.

16. The prefabricated folding structure according to claim 14 wherein said plurality of room ceiling beams are also attached to and at least partially supported by at least one of said pivotable wall members.

17. The prefabricated folding structure according to claim 13 further comprising a flat or conventional roof which is installed on said sturdy habitable structure.

18. A prefabricated folding structure comprising

a) one pre-erected central core comprising two pair of oppositely arranged wall members having a generally rectangular configuration and a floor extending between said wall members wherein a predetermined number of said central core wall members are utilizable as exterior wall members and the remaining central core wall members are interior wall members;

b) two pivoting floor sections;

c) first pivoting means connecting a first pivoting floor section to said central core floor and second pivoting means connecting said second pivoting floor section to the opposite end of said central core floor, said first and second pivoting means each comprising means for transferring the load of said first and second pivoting floor sections to said central core floors and means for reducing frictional forces in said first and second pivoting means during rotation of the pivoting floor sections;

d) two sets of three pivotable wall members;

) first means pivotably connecting eachh of said third of said pivotable wall members to said firsst and second pivoting floor sections respectively, said first pivotal connection means comprising an elongated member ffoldable along a predetermined crease line and capable of substantially maintaining its configuration when placed either in a folded or an unfolded condition aboutt said crease line by a predetermined force, said folded condittion corresponding to a generally parallel initial possition of said third pivotal wall members relative to its rrespective pivoting floor section and said unfolded positionn corresponding to a substantially perpendicular poosition of said third pivotal wall member relative to its reespective pivoting floor section;

f) second means for pivotally connecting each of the remaining pivotal wall members of each set to eachh side of one pair of said oppositely arranged central coree wall members, respectively, said second pivotal connecttion means capable of conforming to a generally parallel iniitial position of said respective remaining pivotable wwall members relative to said central core wall members, to a substantially perpendicular final position; and

g) a plurality of prefabricated roof suppport trusses attached to the upper sides of one pair of opposiitely arranged central core wall members and a pluralitty of folding roof members pivotally connected to said prefabriicated roof support trusses; the prefabricated folding structture capable of forming either

i) a compact folded structure wherrein said two pivoting floor sections and each said of three piivotable wall members are pivotally positioned inwardly about eeach side of said central core so as to rest in close proximitty thereto and substantially parallel to each of said two coore wall members, or

ii) a sturdy habitable structure wwherein said first and second pivoting floor sections and saidd pivotable wall members are pivotally positioned outwardly ffrom said central core so as to define two rooms adjacent tto said central core.

19. The prefabricated folding structure acccording to claim 18 wherein said prefabricated central core contains all necessary and desired plumbing and electrical conntrol means.

20. The prefabricated folding structure accoording to claim 19 wherein said central core contains at leeast a substantially prefabricated kitchen and a substanntially prefabricated bathroom.

21. The prefabricated folding structure accoording to claim 18 wherein said folding roof member comprisses an upper and lower folding roof section wherein each upperr section is pivotally connected at one of its ends to a correesponding lower section and to said prefabricated roof suppport trusses.

22. The prefabricated folding structure accoording to claim 21 wherein said lower folding roof sectionss are at least partially supported by a pivotable wall memmber which is attached to a pivoting floor section.

23. The prefabricated folding structure accoording to claim 22 further comprising a plurality of free sstanding partitions which in said compact folded structuree are positioned substantially parallel to and alongsidde at least one of said interior said central core walls, or when said folding structure has been completely unfolded, aare positioned to further define a predetermined numbber of rooms and closets arranged adjacent to said central corre.

24. The prefabricated folding structure acccording to claim 18 wherein said pivotable wall members and said pivoting floor sections are configured and dimenssioned to provide sufficient free space parallel to said ceentral core walls when the structure is folded for holding noon-pivotally connected building components until said structurre is unfolded.

25. The prefabricated folding structure acccording to claim 24 wherein said non-pivotally connected buiilding materials comprise free standing wall partitions and roof brace supports.

26. The prefabricated folding structure acccording to claim 18 wherein said central core and pivotable wall members include all necessary cable and/or wiring requireements.

27. A method for erecting a sturdy habitablee dwelling from a prefabricated folding structure which compprises:

(a) prefabricating a compact folded struucture according to claim 1;

(b) transporting said compact folded strructure to a construction site;

(c) supporting said compact folded struccture on at least two properly positioned centraal core support means;

(d) unfolding said compact folded the sttructure by

(i) pivoting said first pivoting ffloor section to a horizontal position onto support means;

(ii) pivoting said third pivotable wall member to a vertical position with reespect to said first pivoting floor secttion;

(iii) pivoting said other pivotable wall members; and

(e) finishing final construction detailss to form the sturdy habitable structure.

28. The method according to claim 27 which further comprises adding a plurality of ceiling beams aboove said roof upon said room and central core ceiling beams.

29. A method for erecting a sturdy habitablee dwelling from a prefabricated folding structure which compprises:

(a) prefabricating a compact folded struucture according to claim 13;

(b) transporting said compact folded strructure to a construction site;

(c) supporting said compact folded struccture on at least two properly positioned centraal core supports on a building foundation;

(d) unfolding said compact folded structture by

(i) pivoting said first pivoting ffloor section to a horizontal position onto support means;

(ii) pivoting said second pivoting floor section to a horizontal positiion onto support means;

(iii) unfolding each respective thirrd pivotable wall members to a final positiion relative to said first and second pivotting floor sections; and

(iv) pivoting said remaining pivotaable wall members according to a predeteermined sequence to their final positiions; and

(e) finishing final construction d tailss to form th sturdy habitable structure.

30. The method according to claim 29 whereiin said predetermined sequence of pivoting said remainingg pivotable wall members comprises:

(i) pivoting the outermost wall meember outwardly to a substantially pperpendicular final position relative to saiid central core wall;

(ii) pivoting the next outermost waall member outwardly to a substantially pperpendicular final position relative to saiid central core wall; and

(iii) repeating ii) until all remainning wall members are pivoted outwardly to substantially perpendicular fiinal positions relative to said cenntral core wall.

31. The method according to claim 29 which further comprises adding a plurality of ceiling beams aboove said room and attaching said plurality of ceiling beams to said central core ceiling beams.

32. A method for erecting a sturdy habitablle dwelling from a prefabricated folding structure which compprises:

(a) prefabricating a compact folded struucture according to claim 18;

(b) transporting said compact folded strructure to a construction site;

(c) supporting said compact folded struccture on at least two properly positioned centraal core support means;

(d) unfolding said compact folded structture by

(i) rotating said first pivoting ffloor section around said first pivoting meaans to a horizontal position onto a flooor support;

(ii) rotating said second pivoting floor section around said second pivvoting means to a horizontal position onto a floor support by said second pivotall means;

(iii) unfolding each said third pivootable wall members by said first pivotal connection means to a substantially perpeendicular final position relative to saiid first and second pivoting floor sectionss; and

(iv) unfolding said remaining pivottable wall members by said second pivotall connection means according to a predetermmined sequence to their final positiion;

(e) finishing final construcion details to form the sturdy habitable structure.

33. The method according to claim 32 whereiin said predetermined sequence of pivoting said remainingg pivotable wall members comprises:

(i) pivoting the outermost wall meember outwardly to its final positioon:

(ii) pivoting the next outermost waall member outwardly to its final positioon; and

(iii) repeating ii) until all remainning wall members are pivoted outwardly to their final positions.

34. The method according to claim 32 which further comprises adding a plurality of ceiling beams aboove said roof rooms and attaching said plurality of ceiling beamms to said central core ceiling beams.

35. A method for erecting a sturdy habitablle multi-story structure from a plurality of prefabricatedd folding structures which comprises:

(a) prefabricating a plurality of compactt folded structures according to claim 1;

(b) transporting said compact folded strructures to a construction site;

(c) supporting a first compact folded sttructure on at least two properly positioned cenntral core support means;

(d) unfolding the structure by

(i) pivoting said first pivoting ffloor section to a horizontal position onto support means;

(ii) pivoting said third pivotable wall member to a vertical position with reespect to said pivoting floor section; aand

(iii) pivoting said other pivotable wall members to their final position;

(e) positioning a second compact folded structure above said unfolded first structure;;

(f) unfolding said second compact foldedd structure in the same manner as the first; andd

(g) finishing final construction detailss to form the sturdy habitable multi-story structuure.

36. The method according to claim 35 furtheer comprising repeating steps e) and f) as often as necessary tto form the desired multi-story structure;

37. The method according to claim 35 which further comprises adding a plurality of ceiling beams above said room and attaching said plurality of ceiling beams to said central core ceiling beams.

38. The method according to claims 37 further comprising installing a flat or conventional roof to the uppermost structure after it is unfolded.

39. The method according to claim 35 further comprising providing the uppermost structure with a plurality of prefabricated support trusses attached to its central core ceiling members and a plurality of folding roof sections pivotably connected to said prefabricated roof trusses.

40. The method according to claims 39 which further comprises pivoting said plurality of folding roof sections in upper and lower folding roof sections wherein each upper section is pivotably connected at one of its ends to a corresponding lower section and to said prefabricated roof support trusses.

41. The sturdy habitable structure produced according to the method of claim 27.

42. The sturdy habitable structure produced according to the method of claim 29.

43. The sturdy habitable structure produced according to the method of claim 32.

44. The sturdy habitable multi-story structure produced according to the method of claim 35.

45. The sturdy habitable structure producedd according to the method of claim 36.

FIG. 1

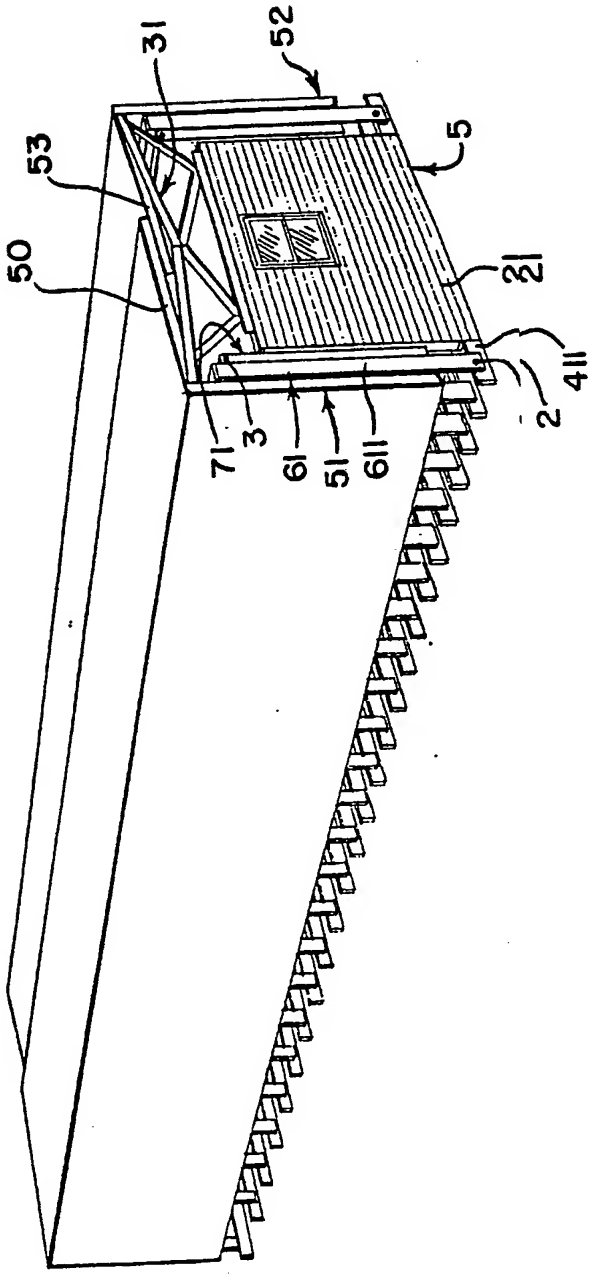

FIG. 2

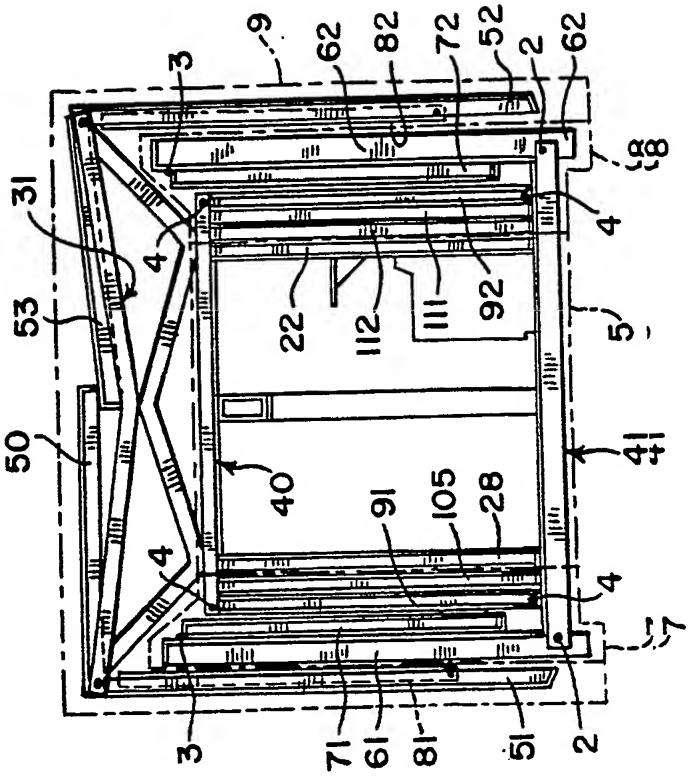
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FIG. 4

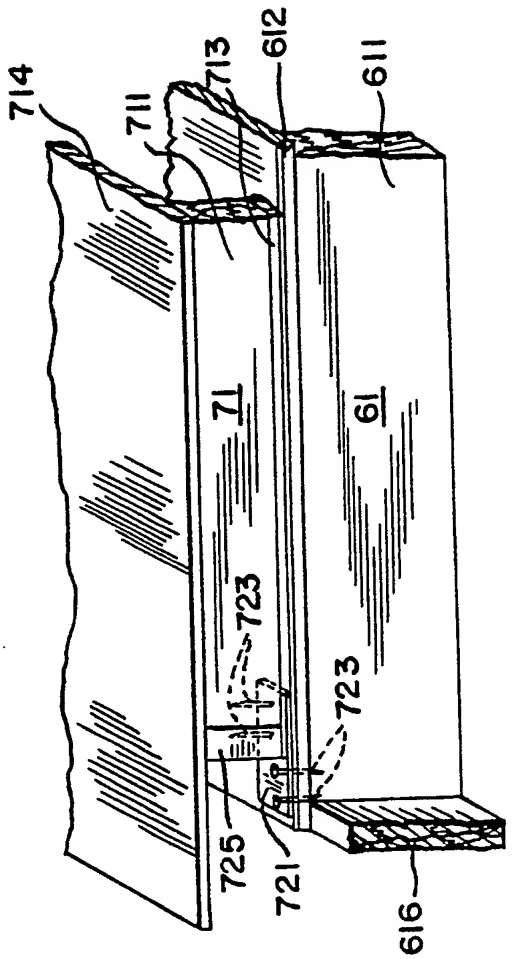
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FIG. 3

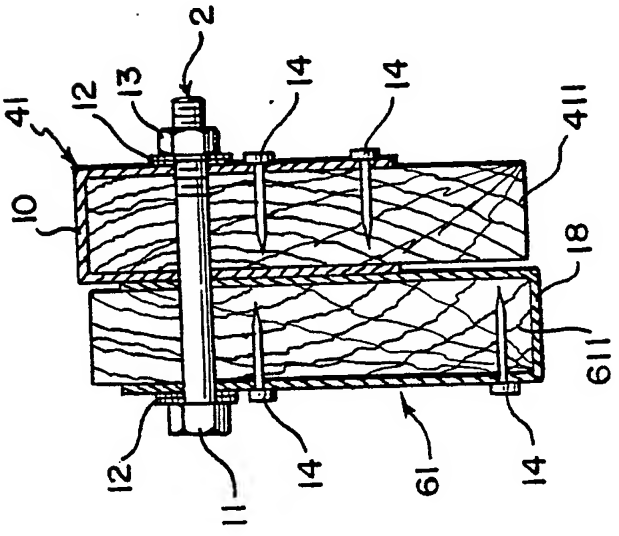
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FIG. 5

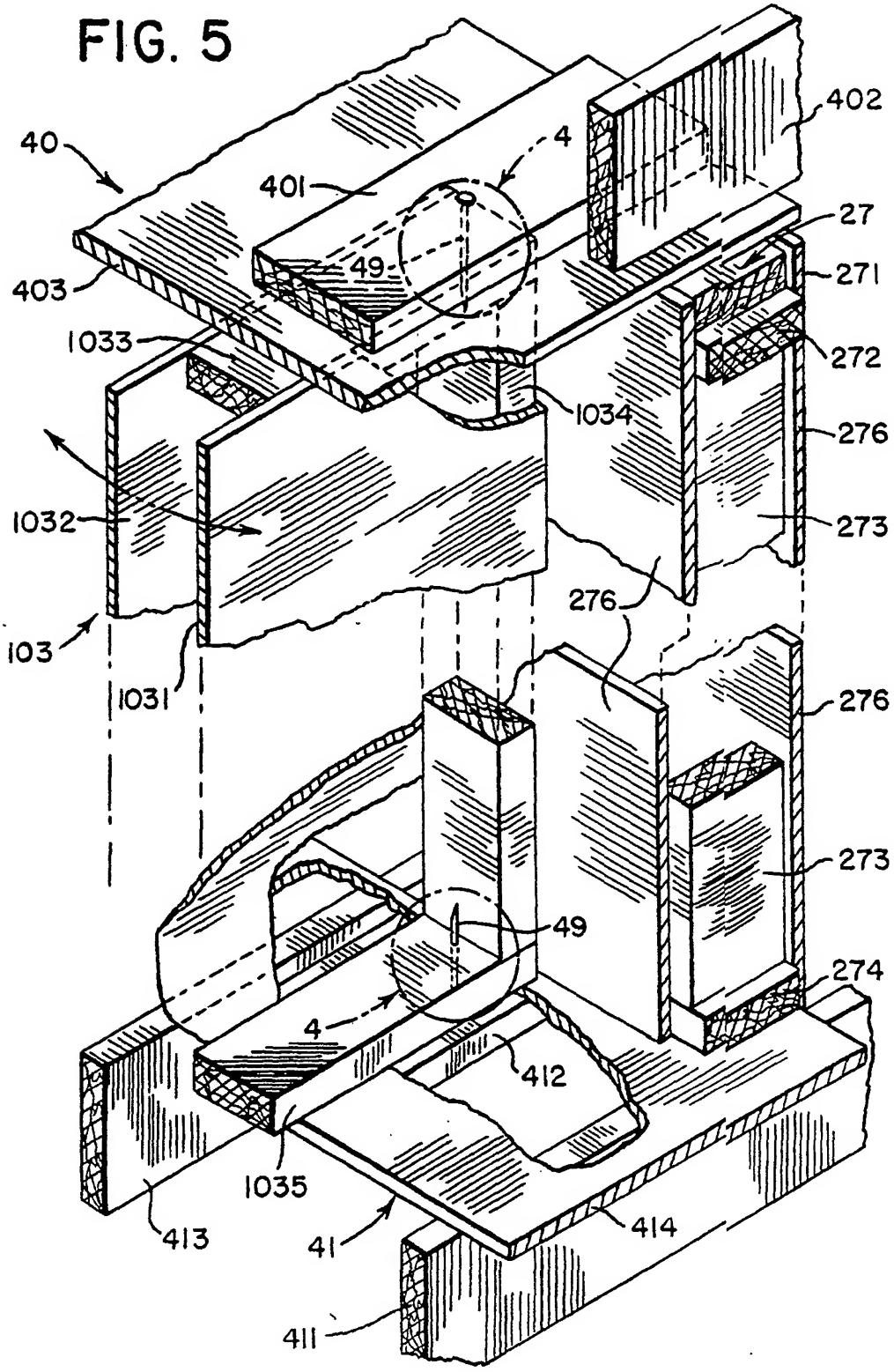
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FIG. 6

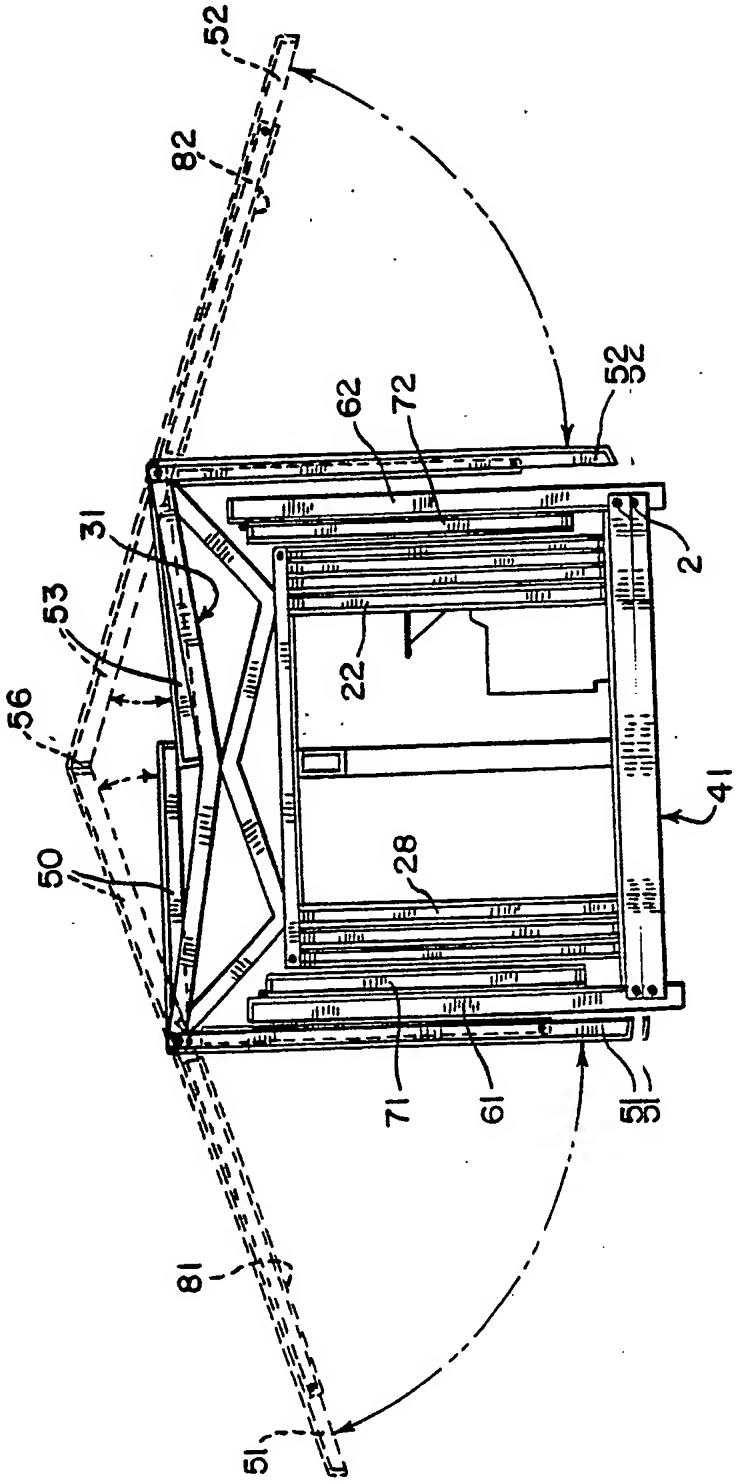


FIG. 7

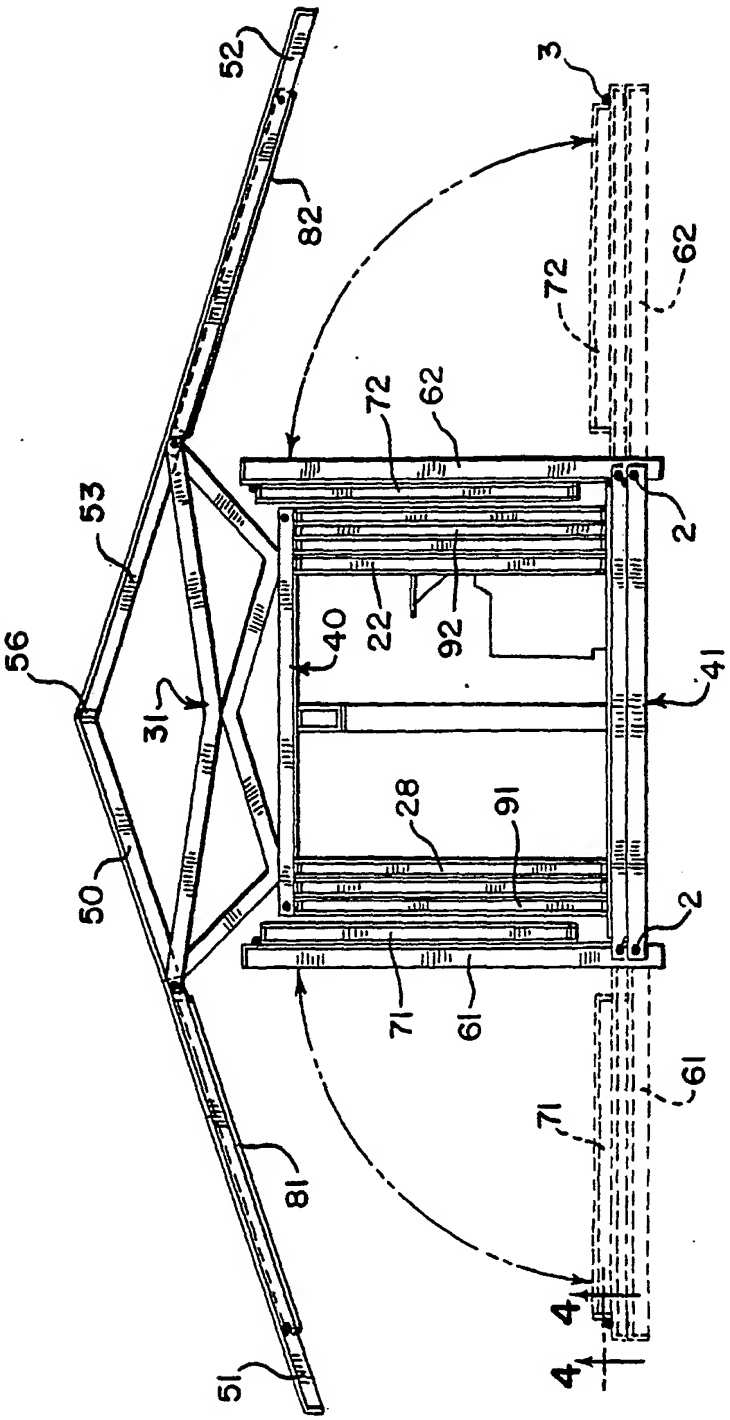


FIG. 8

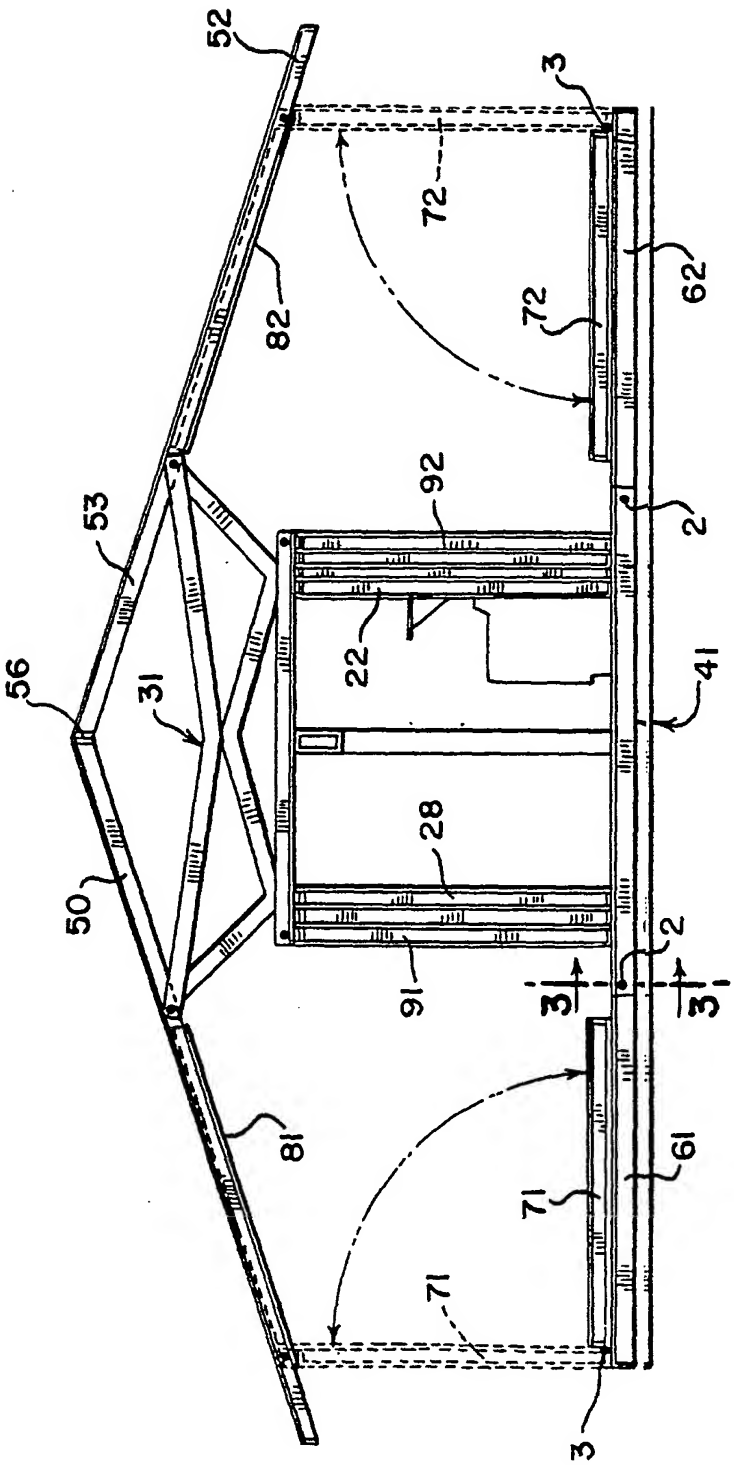
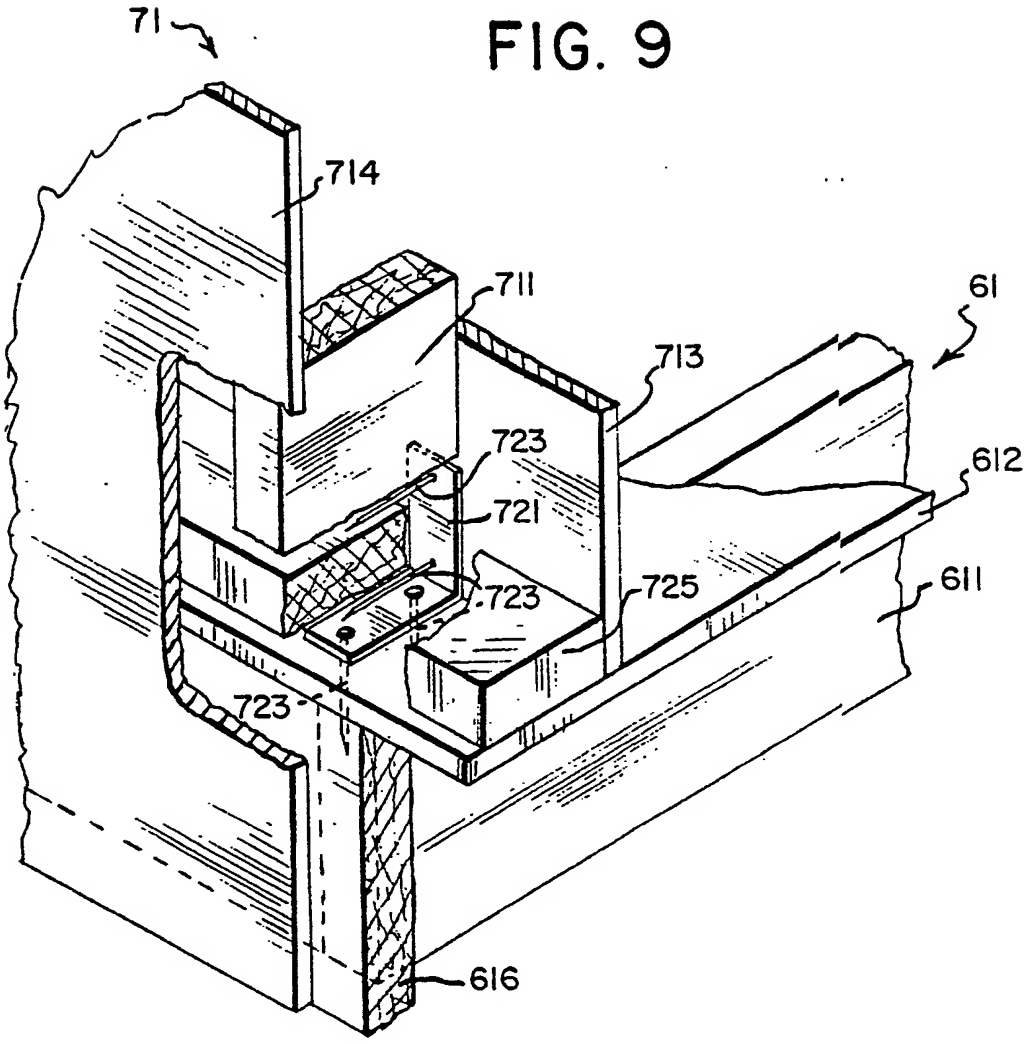


FIG. 9



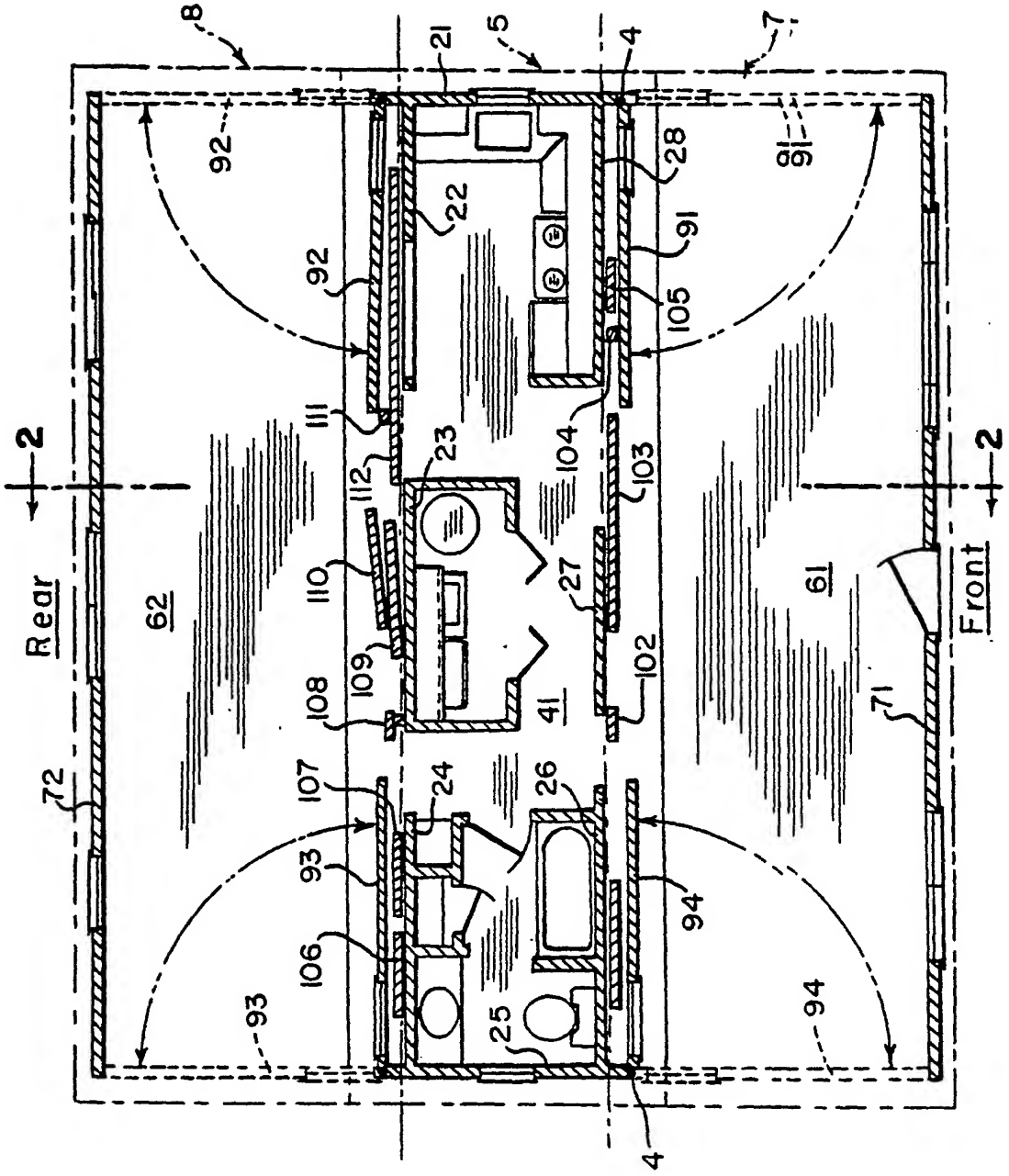

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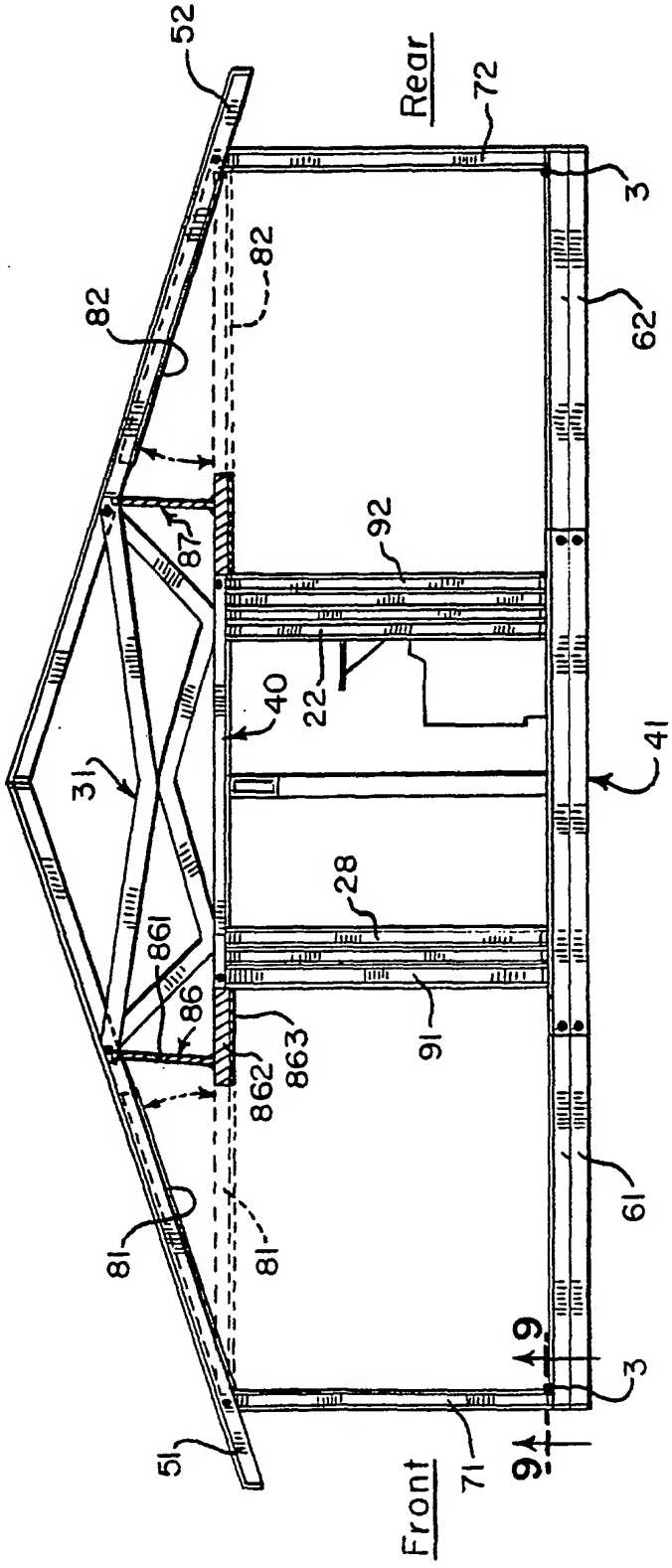
FIG. 10

FIG. 11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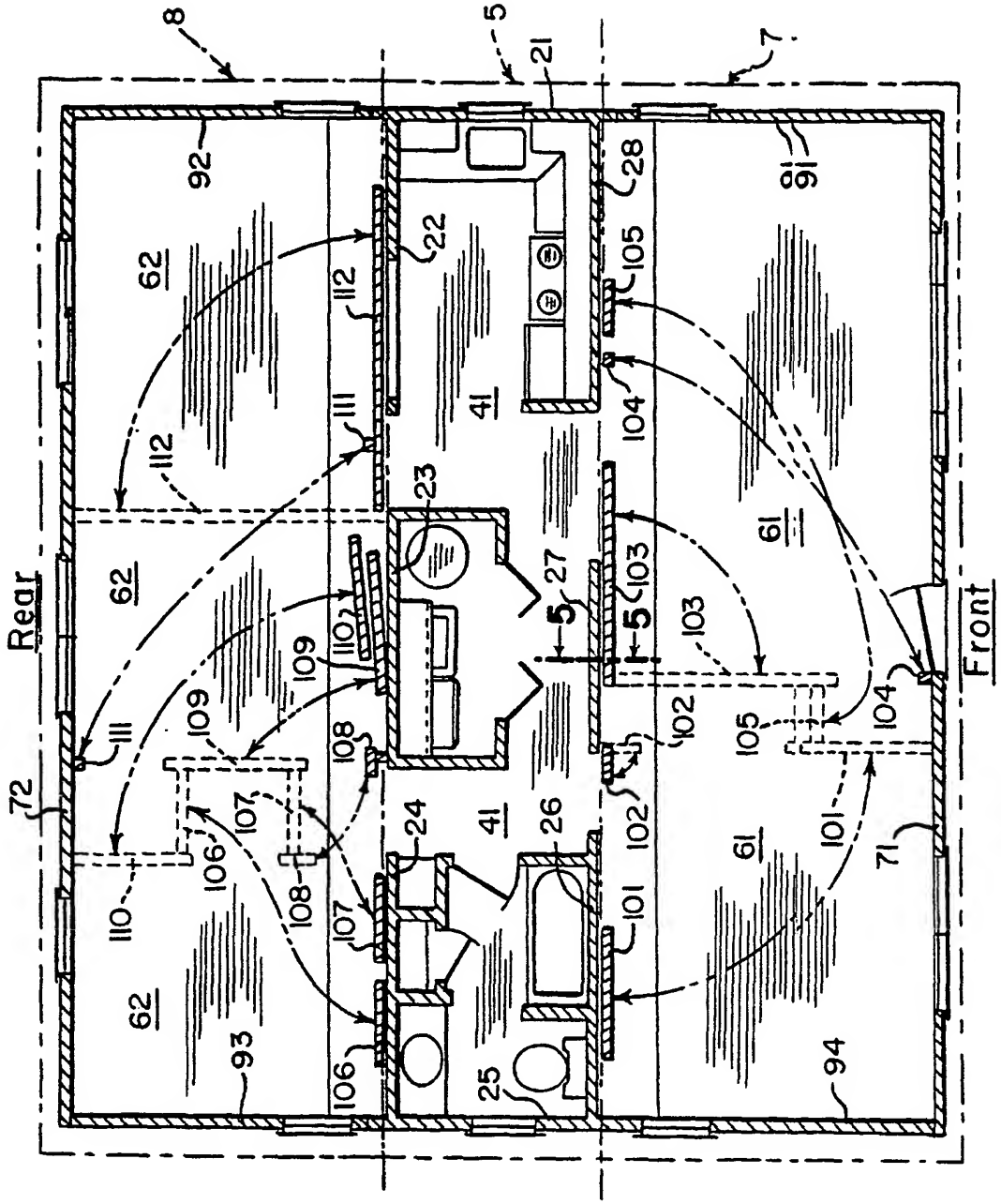
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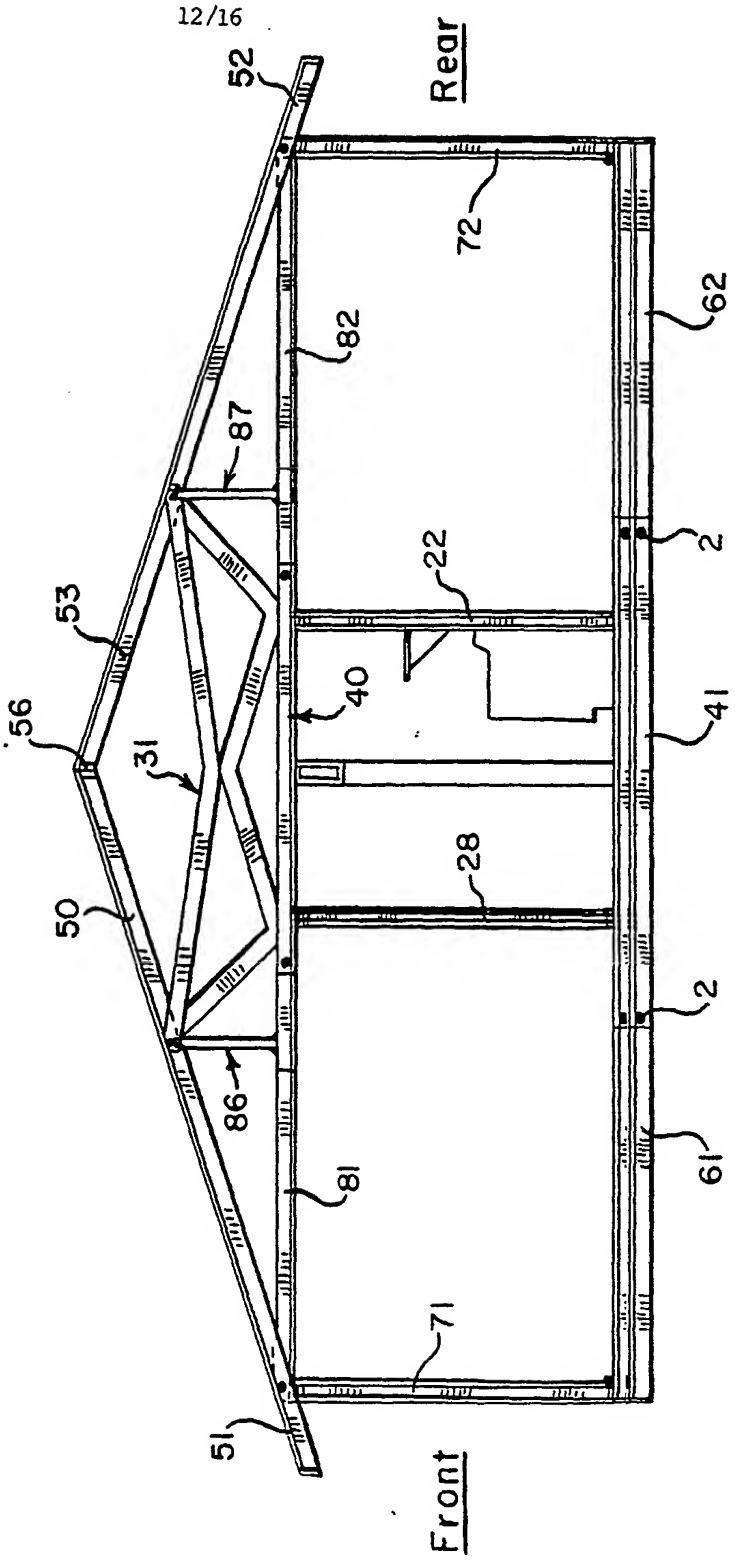
FIG. 12

FIG. 13



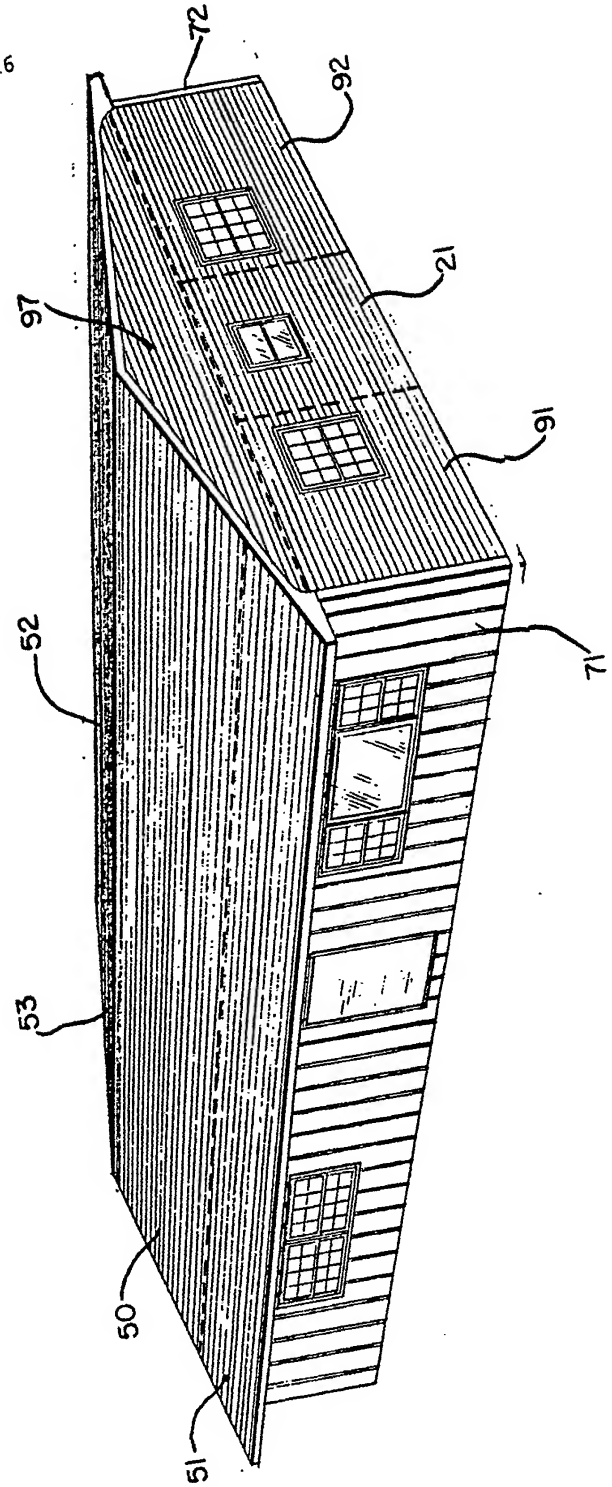


FIG. 14

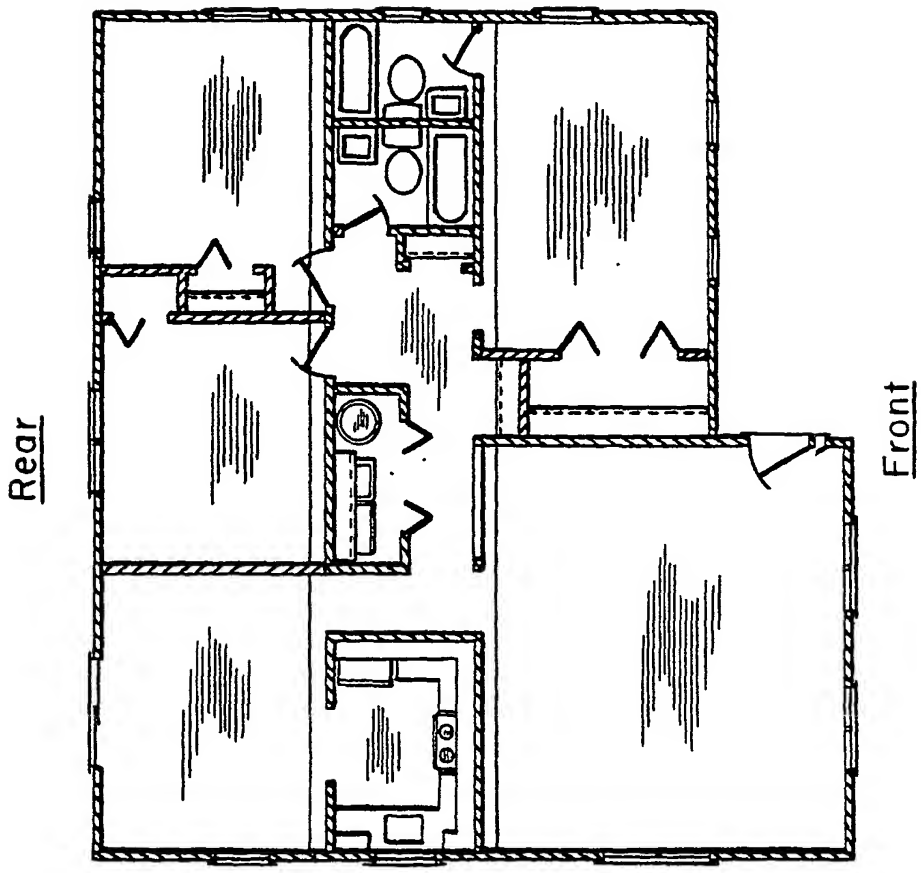


FIG. 15

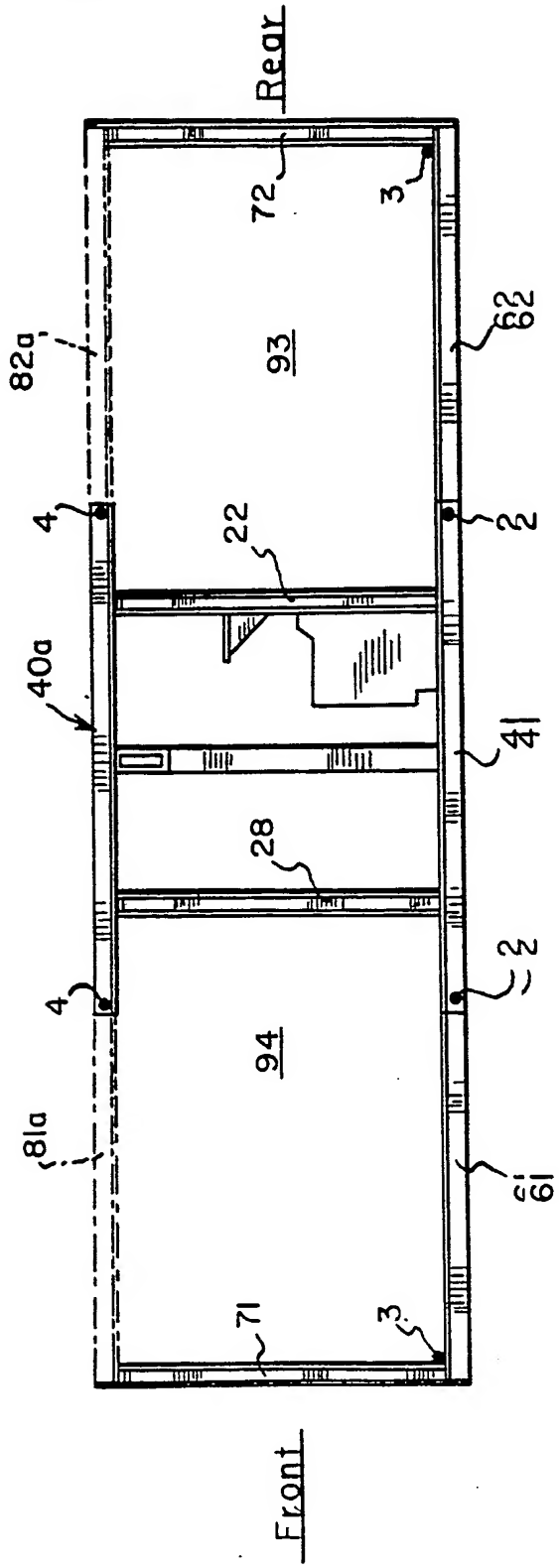
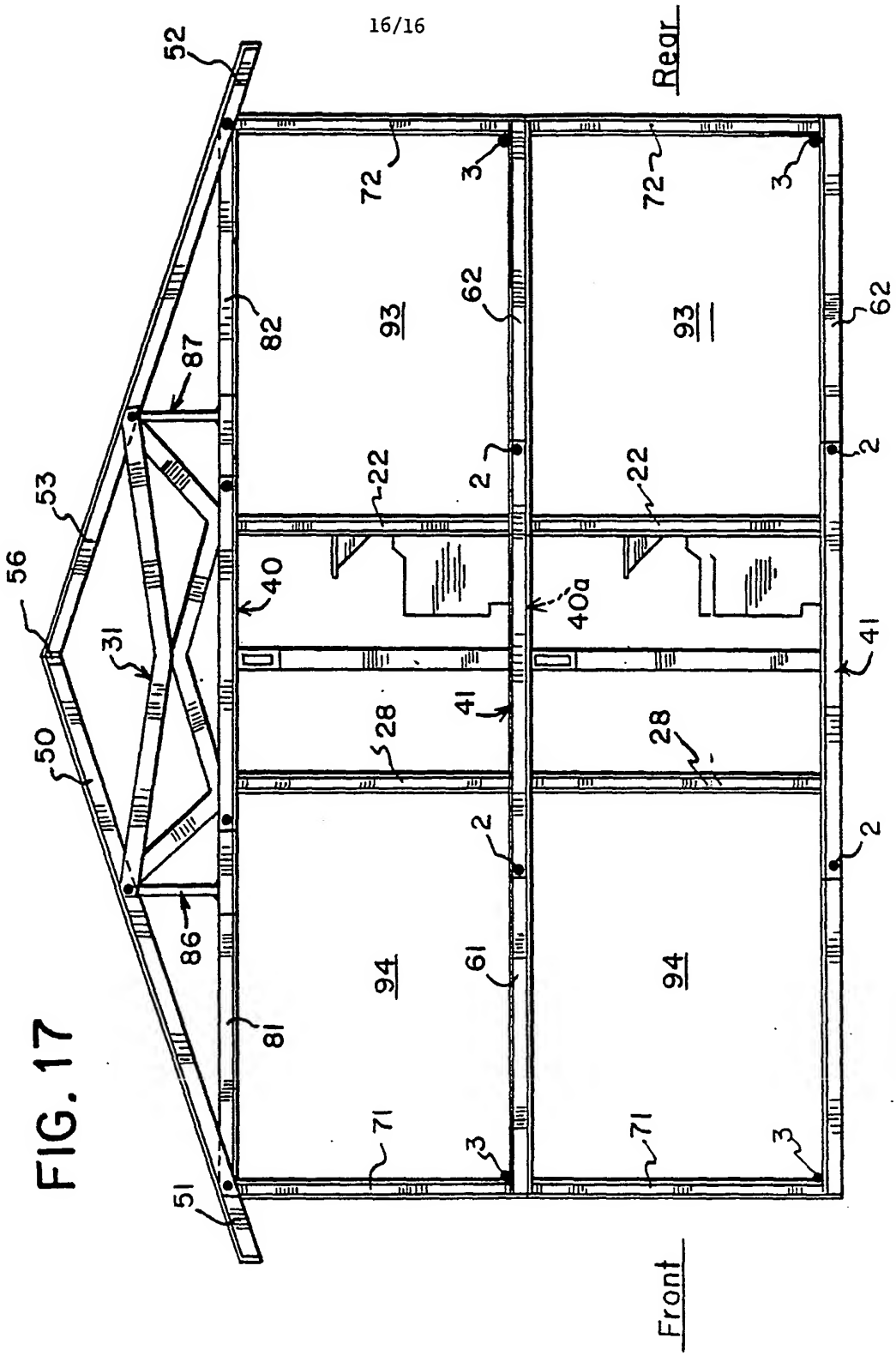


FIG. 16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51

FIG. 17

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 85/00194

I. CLASSIFICATI N OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. E04B 1/344
U.S. Cl. 52/79.5

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	52/22,64,68,69,71,79.1,79.5,234;236.3,236..6,243.1

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevavant to Claim No. [18]
Y	IT, A 574,311, published 15 March 1958 Desagnat et al	1--45
Y	N, New York Times Real Estate Section [illegible] published 20 January 1980, W.G. Blair "Factory-Built House unfold on Site" see pages 1 and 4	1--45
Y	US, A, 3,107,116, published 15 October 1963 Meaker	18--26 & 39
Y	US, A, 4,070,804, published 31 January 1978 Van Der Lely	18--26 & 39
Y	US, A, 3,857,211, published 31 December 1974 Sharpton	35--40,44,45

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theheory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannotot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or morore other such documents, such combination being obvious is to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [3]	Date of Mailing of this International Search Report [3]
12 April 1985	29 APR 1985
International Searching Authority [1]	*Signature of Authorized Officer* [20]
ISA/US	J. K. Bell

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